THE SURVEYOR, ENGINEER, AND ARCHITECT;

OR,

LONDON MONTHLY JOURNAL OF THE PHYSICAL AND PRACTICAL SCIENCES

IN ALL THEIR DEPARTMENTS.

BY A COMMITTEE OF PRACTICAL SURVEYORS, ENGINEERS, AND ARCHITECTS, OF MUCH EXPERIENCE AND IN ACTIVE EMPLOYMENT.

ROBERT MUDIE, LITERARY CONDUCTOR.

THE BERLIN MUSEUM.

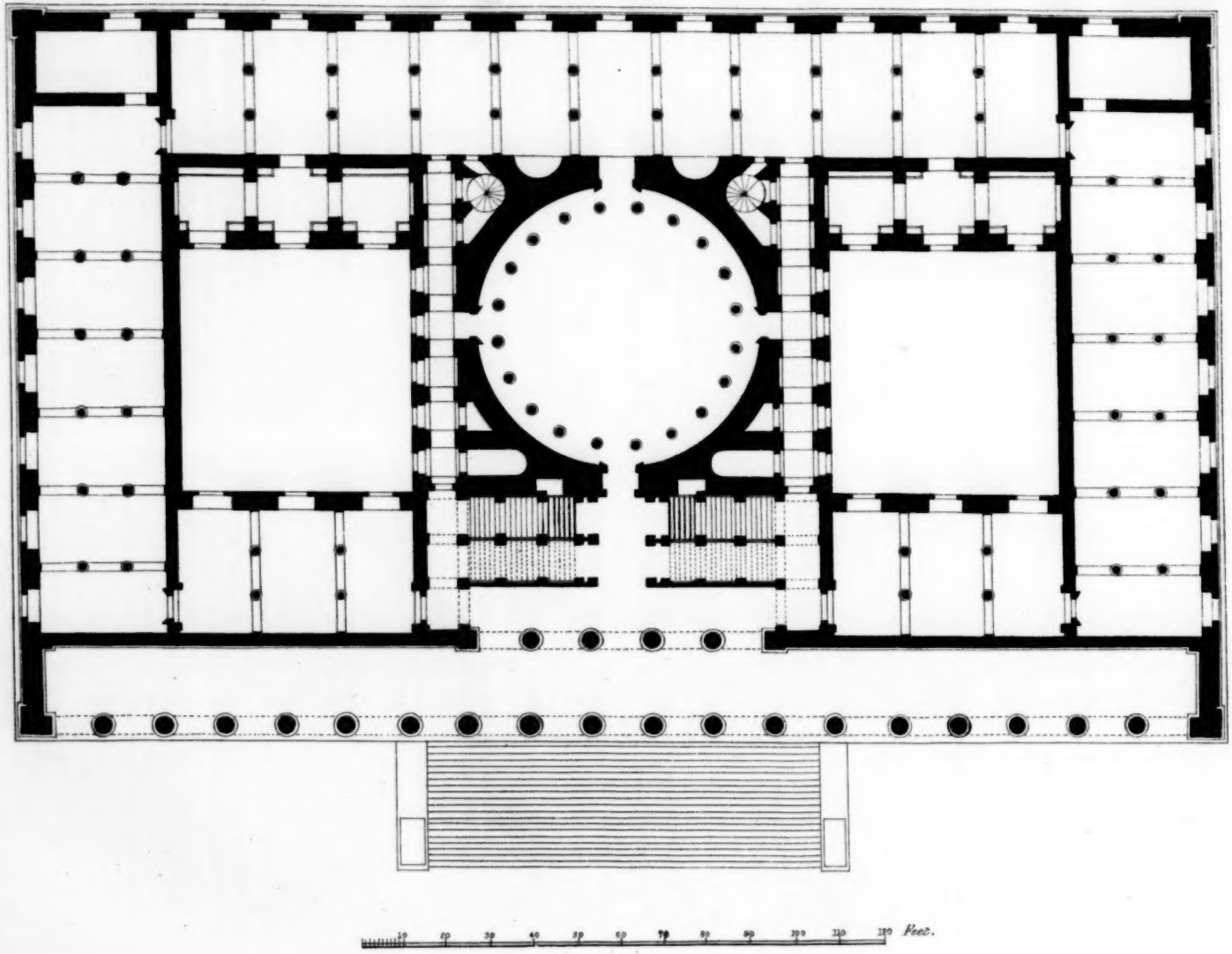
In entering upon an architectural examination of this work of Schinkel's, it is hardly possible to avoid taking some notice of the very opposite judgments passed upon it by a critic in the Foreign Quarterly, and by Mr. Joseph Gwilt. The publication just mentioned was the very first, we believe, which introduced Schinkel's name to the English public, and may thereby have contributed to bring his "Entwürfe," or collection of designs, into notice among the profession in this country, earlier than might otherwise have been the case. And, as the article alluded to contains a good deal of information—at that time quite new—relative to several of the modern architects of Germany, it might have been imagined that no one could take offence at it, even though some of the writer's opinions might be objected to, and some of his commendations considered too strong. Or, if it was to be censured at all, the more proper course would have been to attack and expose it at once, instead of waiting, as Mr. Gwilt did, several years, and then bringing out a work nominally professing to be "Elements of Architectural Criticism," but which, in reality, consisted almost entirely of strictures—and those no very gentle ones—on the article in the Foreign Quarterly. We do not say that Mr. Gwilt was not perfectly at liberty to animadvert as freely as he pleased upon the essay in question; on the contrary, we are disposed to give him credit for taking up his pen in order to refute what he considered unsound and dangerous criticism; yet we cannot conceive why he should have shown himself so exceedingly angry, more especially at that distance of time. However, he soon found out that he had roused an adversary who was, perhaps, more than a match for him,—one expert in retort, clever in argument, and who not only took him and his book to pieces, but gave him one or two severe thrusts in reply to some of his incidental and rather irrelevant remarks.

What we have just been saying, will probably be thought irrelevant to our own subject; nevertheless, it is sufficiently connected with it, because it so happens that the design of the BERLIN MUSEUM had particular notice bestowed upon it by Mr. Gwilt, who, by way of convincing his readers how paltry a piece of architecture it was, introduced a most paltry and libellous representation of it into his book. Of what the design was—of the façade at least—externally, our readers will be able to form a tolerably fair notion from the elevation given in our last Number, due allowance of course being made for the unavoidable smallness of the scale, and also for the circumstance that a geometrical drawing, let its scale be what it may, cannot possibly give an idea of the perspective effect produced in the building itself, by the variety within the colonnade, where there are other columns behind those in front, forming a centre compartment of five open intercolumns, beyond which is seen the screen in which the door-way is placed, and again, over that, the upper part of the principal staircase leading to the picture rooms and gallery of the Rotunda. Further, it must be borne in mind, that, besides the powerful effect both of perspective and of light and shade, the walls which form the back ground to the external colonnade, are incrusted with marbles, and have compartments filled with subjects in relief, and the upper part of each division, on either side of the centre, is decorated—or at least is intended to be, for we cannot speak positively as to the paintings being actually executed—with a single large fresco; and, in order that the dimensions may be estimated, it should be observed that the columns are forty-eight feet in height, and the extent of the front two hundred and seventy-six.

After describing the façade somewhat more minutely than we have done, as our engraving has relieved us of that task, the writer in the Foreign Quarterly says: "Here let us pause, and ask if there be any other modern work of architecture to be parallelled with this, when all its decorations shall have been completed? What simplicity of outline, yet what variety and originality in the design! What classical feeling combined with novel invention! What exuberant pomp, yet what refined chastity of style! Here the great German master has conceived an edifice worthy to be a palace of the arts: liberal, but not profuse, he has arrayed its halls in loveliness and splendour, and has thrown around it the halo of a poetic imagination." Now this may doubtless be allowed to be somewhat flowery; it is not exactly in the style in which architectural specifications are drawn up; yet surely the warmth the writer displays is excusable enough, in speaking of a work of art; or if not, some of the finest passages in criticism are in very bad taste. As Mr. Gwilt, however, did not at all sympathise with the writer in his admiration of Schinkel, he pronounces what we have just quoted to be "stilted and bombastic nonsense." "Simplicity of outline," he goes on to say, "of course means the long parallellogrammatic front, without a break to relieve its monotony, with the poverty of a *single* rank of columns," though the plan given in his own plate shows that there is a range of inner columns, forming a tetrostyle in antis in the centre; and he further objects that the crowning member is frittered by a row of eagles, and that the staircase—of which only the upper part can be seen over the screen—renders it evident that, though there is only a single order, the building is divided internally into two floors. Now, if that be not hypercriticism, we know not what is, or where Mr. Gwilt will find a modern edifice that will escape his censure. Most certainly it will not be the Post Office, for there we behold two ranges of windows within a single order; nor is it likely, for a contrary reason, to be Saint Paul's, because there, while there are two orders externally, there is no division within. Neither will it be St. Martin's Church, of which he professes himself so very great an admirer. In fact, his objection—if it were consistently adhered to—would extend far more forcibly to every thing in modern architecture, save and except the very design against which he levels it, and more especially to his own favourite Italian style, where façades are cut up by mezzanine windows, not unfrequently introduced into friezes. It is, again, quite incomprehensible to us how he can talk of the

GROUND PLAN OF THE MUSEUM AT BERLIN.

SCHINKEL. ARCHITECT.



L. Schenberg lithog: 10 Hatton Garden.

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prat above the entablature being frittered by the eagles placed upon it, unless he means also to protest against that accumulation of parts and ornaments in which Italian architects indulge, placing attics with windows in them over orders, balustrades over attics, and rows of statues again on balustrades, which at a little distance look like so many pinnacles; whereas, the ornaments here introduced only break the outline, and Mr. Gwilt might just as well pretend that the antifixæ over the cornice of a Grecian temple "frittered" its design. In like manner—that is, if he cares to be consistent—the 'long parallellogrammatic' sides of Greek buildings, which had seldom more than a "single range of columns" in those external elevations, with merely an unbroken surface of blank wall behind them. He complains of the want of variety and of light and shade, and that all is sameness—from which strange remark one would imagine that either he had never seen the plan, or else could not understand from it, that the centre portion within the colonnade is thrown almost into a mass of shadow, against which the inner columns relieve themselves most picturesquely, yet without interfering with, or disturbing the design. He then concludes his criticism by saying that the whole appears to him "more like the composition of some painter than of an architect," and that the Foreign Quarterly reviewer's encomiums are "mere verbiage;" yet do not his own remarks partake more of "mere verbiage" than of argument, for why should he liken the design to a scene-painter's composition, if it really be, as he pretends, most of all deficient in precisely those very qualities and effects at which a scene-painter would aim? Now, with all deference to him, the world has seen before now some truly splendid architectural fancies in the shape of theatrical decorations—gorgeous impossibilities—things by far too magnificent to be realised; for it may be said of them as has been said of some of Piranesi's subjects, that to execute them would exhaust the Indies. "Scene-painter" is of course intended for a bitter sneer, yet what were such artists as Servandoni, Quaglio, and Sanquirico but scene-painters—artists who revelled in all the scenic effects which architecture affords. Most undoubtedly, though very simple in its elevation and general outline, the façade of the Berlin Museum is unusually scenic; and we can only say, that though Mr. Gwilt of course considers that epithet to be one of reproach, we wish we could with any sincerity apply it to some of our recent buildings here at home.

Thus far, however, we have merely opinion against opinion—in point blank opposition to each other it must be confessed; but there is a third party's opinion to be brought forward, which will leave Mr. Gwilt in a most terrible minority. Herr Schaubert, a German artist, on his return from Greece, where he had been employed in making architectural researches, declared, that even after studying the Parthenon and Erechtheion, he was most forcibly struck by the beauty of the Berlin Museum, the façade of which was, for the taste displayed in it, incontestibly superior to every other modern building in Europe:—"*Schien ihm alle Gebaude des heutigen Europa zu übertreffen!*"

Perhaps Mr. Gwilt may object to such testimony in favour of Schinkel's edifice, as coming from one who, though he may otherwise be a competent critic, is likely to have been unduly biassed by partiality towards a countryman. Such exception to it might, indeed, be reasonable enough, had Herr Schaubert been appealed to by the disputants, to settle their difference by his casting vote; whereas, he probably never even heard of either of them, and expressed his opinion without the slightest idea of its being ever referred to at all in this country. To the best of our knowledge also, not a single individual besides Mr. Gwilt has ever expressed, publicly at least, disapprobation of this production of Schinkel's. We have never met with even a solitary remark to that effect anywhere, though, had we done so, it would certainly not have passed unheeded by us.

Hardly need we say formally to which side of the question our own opinion inclines, as our readers must by this time have made the discovery for themselves. We might, indeed, have given our own criticism on the architecture, without referring to what others had said on the same subject; but then in what light should we have been regarded by those who, having read Mr. Gwilt's "Elements,"* would have found us speaking favourably of what had there been condemned in such unqualified terms? Justly might they have reproached us with indulging in commendation that was apparently quite undeserved, similar opinions having been flatly contradicted on a former occasion, when they proceeded from a different quarter. No, we could hardly have adopted any other course than we have done: and, if we have entered rather at length into the case of the Foreign Quarterly reviewer and Mr. Gwilt, we have not thereby extended our article much beyond what it would have been had we discussed the architectural merits of Schinkel's building, without noticing what has been said of it elsewhere. At all events, our readers will now see that something has been said against, as well as for it; nor, we conceive, will the interest of the subject we have selected be at all diminished by knowing the controversy it has occasioned in this country. As a piece of architecture, the Berlin Museum has been aspersed by Mr. Gwilt, and we are therefore willing to have it plainly understood that we are disposed to vindicate it.

The façade is eminently beautiful,—quite pure from any disagreeable alloy,—from any of those blemishes—or we might term them blotches—which disfigure not a few of the 'classical' works, that excite got-by-heart critical raptures:—such, for instance, as the colonnade of the Louvre, clapped upon a substructure its very antipodes in taste and in style; or the portico of St. Martin's, attached to a most ugly ill-favoured edifice. Still, though we do not say it is faulty as it is, it being quite in accordance with Hellenic examples of the order, we regret that Schinkel did not treat the cornice with more spirit and freedom, giving it dentils and additional bed mouldings, so as to render it more important—more ornamental and expressive, than it is at present. That he can, when he pleases, be strikingly original,—can, while deviating from Grecian precedents, imbue his own inventions with Grecian refinement and taste,—is evident from the capitals he has given to the columns in the sculpture galleries within this very building; and we are therefore of opinion, that had he taken the liberty to compose a cornice that would have been more *effective*—have *told* better as the principal crowning feature to the whole mass, the whole design would have been materially improved by such *licence*. As regards the other elevations, although they have little ornament except what they derive from their windows, they are, if in a much plainer, by no means in a bald style. On the contrary, the general character is kept up quite as much as the inevitable difference between *columnar* and *fenestral* design would allow; and the whole of the entablature is continued quite around the edifice. It will further be seen, from the ground plan, that the windows are not

* It is not, it would seem, reviewers alone who have such bad taste as to run counter to Mr. G.'s opinions, for Mr. Bartholomew has lately expressed himself in terms of the highest, not to say rapturous admiration of German architecture.

crowded together; that they are kept at some distance from the angles of the building, by which means the elevations acquire an air of solidity; and that there are no breaks of any kind.

We now come to speak of the ground plan itself, and the interior; and in order that the situation may be understood, we should observe that the Museum is very favourably located, it being at one extremity of the *Lust-garten*, facing the Royal Palace, and the principal front having a southern aspect, inclined however a little to the east. It is true the Lust-garten is but of moderate extent,—the whole area perhaps about the size of Lincoln's Inn Fields—bordered on its longer sides by rows of trees; yet this is rather an advantageous circumstance than not, inasmuch as, while the space is sufficient to allow the building to be viewed to advantage, it is not so great as to take off from its importance.

The plan discloses at once one important circumstance, to which we have already adverted, but which is impossible to be understood from the elevation alone; namely, the picturesque character given to the back-ground of the colonnade by a second row of columns, and by the screen, between the portico and lower part of the staircase. In the management of the staircase itself, we think that the architect has availed himself most happily of the peculiar nature of the building, so as to introduce a most striking piece of design. Another would probably have omitted the inner columns, and continued the back wall of the portico from end to end, making an enclosed vestibule. Yet, to say nothing of what would have been so lost in regard to external design and effect, such vestibule filled with a staircase would have looked small and confined; whereas, now, though the space occupied by the stairs themselves is one of very moderate extent, owing to its being entirely open above, and merely screened off from the portico, it does not strike one as being small, in the same degree as a larger, but shut-up, vestibule and staircase would do. On ascending the second flight, on either side, the eye catches a view into the portico, and on reaching the landing the spectator enjoys a fine piece of architectural scenery as he looks through the double file of columns into the Lust-garten. Such a view—though it can be but very inadequately represented in a drawing—forms one of the architectural plates of the building in Schinkel's own work. Before proceeding further, it may be as well to rebut at once an objection likely to be made by matter-of-fact people, who may think that if effect has been obtained, convenience has also been sacrificed; for who, they may ask, would build a staircase which, though certainly under cover, is nevertheless open to the weather. Most undoubtedly, in any sort of habitation, or even in a theatre, or other public building of that kind, an open staircase would be somewhat preposterous; but in a museum the case is different. It is visited only in the day-time, and people do not take off their cloaks and other walking habiliments; therefore no more inconvenience arises from the staircase being open, than from the portico itself not being walled in.*

The plan of the Museum is so simple, as to require very little in the way of explanation, since almost the whole of the ground-floor is appropriated to galleries and rooms for sculpture, excepting one or two cabinets for medals, &c, We have, therefore, deemed it unnecessary to insert letters of reference, there being no occasion to particularize the respective rooms, or to point out the two inner courts and the rotunda. This last is 66 feet in diameter by 70 in height to the summit of the dome, which, like that of the Pantheon, admits the light through a single *eye* or circular aperture, 22 feet in diameter, and covered with glass of most enormous thickness. In the lower part of this rotunda is a peristyle, whose columns have Greek Corinthian capitals, supporting the gallery on the level of the upper floor (21 feet above the pavement); consequently this order is small, being only half the height from the pavement, to the spring of the dome; but it was almost indispensable to have a gallery above, and to have made that a hanging one, projecting and suspended midway, would have had a worse effect.

The sculpture rooms on the ground floor have little other architectural decoration than what they derive from their ceilings and columns, the capitals of which last (already alluded to by us) present several varieties of an enriched, or we might say, *Ionian* Doric, their carved mouldings and neckings giving them much of the florid Ionic character, though, in consequence of there being no volutes, they partake in their general form quite as much of the Doric. It must not however be understood by this that they are no more than Grecian Ionic capitals divested of their volutes,—but without giving drawings of them it is impossible to make any comments on them that would be intelligible to our readers, unless they should happen to be acquainted with the delineations of them in Schinkel's work; all therefore we shall add in regard to them is, that it is to be regretted they were not passed off as copied from genuine relics of antiquity lately brought to light; because in that case their fame would have spread like wildfire; while, as they happen to be only inventions, and not discoveries, they are deemed hardly worth notice, though in reality very much more so than some of those very interesting *mare's-nest* sort of things respecting which antiquarian travellers bring home such magniloquent reports, though their own sketches show them to be scarcely worth notice at at all.

The arrangement of the upper floor is precisely similar to that below, the only difference being, that instead of having columns, each gallery is portioned off by screen walls (17 feet high, or 7 feet lower than the rooms themselves), extending at right angles from the piers between the windows, so as to leave on the side opposite the windows a clear space, about one-third of the entire breadth, from end to end. Undoubtedly the effect of an imposing *coup-d'œil* on first entering, is in a manner lost; still the mode here adopted has its advantages; for a series of separate cabinets is thus obtained, without the galleries being absolutely divided off into so many distinct rooms; and another convenience is, that all the pictures are viewed by a side light, being hung only against the screens, each of which affords, of course, two surfaces for that purpose. One circumstance materially in favour of this arrangement is, that a visitor's attention is not fatigued by a host of pictures meeting his eye at once, but he may examine the contents of one or more of those recesses from time to time. Whether it would not, after all, have been more advisable to light the picture galleries entirely from above, is a question we do not take upon us to decide, but it could hardly have been done here without greatly modifying the exterior on three of its sides. Windows on the lower floor were inevitable; and to have substituted either niches or blank windows for the upper ones, would certainly not have been an improvement, as may be seen by the façade of our own National Gallery, where, in consequence of there being windows below, and niches above, an expression of weakness where there should be most strength, and of heaviness where lightness would be more in character, takes place. Undoubtedly the picture-rooms of the Pinacotheca at Munich,

* There would be nothing objectionable, on the score of inconvenience, to allowing the staircases to the galleries of churches to open in their upper part into a portico or loggia; while there is no doubt that such mode might be made to contribute very materially to effect.

make a finer display than those of the Berlin Museum; for they form a series of spacious and lofty saloons lighted entirely from above, and highly enriched in the upper part of their walls and their vaulted ceilings, by which means the space left for hanging pictures is so reduced as to height, that none can be placed out of sight, as is always the case with a great number in our exhibition-rooms. The same advantage is secured in the Berlin Museum, by the screens; and neither in this nor in the other building can any pictures be hung lower than within three or four feet from the floor, whereas, at our Royal Academy's annual picture-shows, one generally sees a row of small unfortunates placed where they can be examined only by those who have a second pair of eyes in their feet.

Of the numerous works of art contained in the Berlin Museum, it would be quite idle in us to attempt to give here any sort of account. We shall, accordingly, merely remark, that they are divided into the following classes, viz :—ancient sculpture, Greek vases, &c. ancient and modern medals, bronzes, terracottas and majolicas, and pictures. The last consist of all the choicest and most valuable works from Sans Souci and the other royal collections, besides those which formed the celebrated Giustiniani and Solly collections, which last was purchased by the king for 700,000 dollars, a sum greatly short of what it had cost its proprietor, who is reported to have paid down on the spot two millions of francs for the six paintings forming the celebrated altarpiece, by John and Hubert Von Eyck, a price which had been refused by each of the allied soyereigns at the congress of Aix-la-Chapelle!

The Museum was opened to the public on the 3rd of August, 1829, six years from the time when the building was first begun.

ELEMENTARY LESSONS

IN THE THREE PROFESSIONS, OR ANY OF THEM.

NO. II.—NUMBERS.—NO 2.

COMPOSITION OF NUMBERS.—Every number which consists of more than a single figure, is, in one sense of the word, a composite number; for it is made up of the sum of as many numbers of different denominations as it contains figures. So also a number consisting of one figure, is made up of as many equal numbers of the same denomination, as there are 1s in it. This, however, is not the composition of numbers which is to be understood, because it is of comparatively little use in practice.

A *Composite* number, in the proper sense of the term, is one made up of the product of two numbers multiplied together, or of more numbers than two, the product of two being multiplied by the third, that product by the fourth, and so on, until all the numbers are used as multipliers, except the first, which is the multiplicand. Any of the numbers may be taken for multiplicand, and the multipliers may be taken in any order: upon the same principle that 5 times 3 is equal to 3 times 5.

The numbers which thus by their multiplication make up a composite number, are called its *factors*, and if they are all prime numbers, they are called its prime factors; and in this case they are the most numerous, and, individually, the smallest possible.

The factors of a composite number, are also called the *divisors* of it; and when they are prime numbers, they are called the prime divisors.

A prime number is one which is not a product of any two or more factors, and which of course cannot be divided without remainder by any number but 1, and itself, which is, in fact, no division at all.

That the alternation of prime and composite numbers, in the natural order, 1, 2, 3, 4, &c., does follow some law, is certain; but, as every additional number alters the law, it cannot be investigated upon any general principle; like many other matters, the mere beginning of it is exceedingly simple, but it soon becomes so difficult as to defy the skill of the most profound arithmeticians.

One principle is, that every number which, with 1 added to it or subtracted from it, is divisible by 6, is a prime number; but the converse does not hold good; for every prime number is not thus divisible; and so the principle is of little use in practice.

Still it may be useful to such as wish to be thoroughly acquainted with numbers, to see the investigation from which this is deduced.

Now, reckoning from 1, in the natural succession, 2 is the figure in the second or first even place; and it follows that all numbers in the even places of the natural scale, of how many figures soever any of them may consist, are divisible by 2. In like manner, every number which occupies a third place, must be divisible by 3; and this holds true of all numbers whatsoever. Thus, for example, 17 divides 34, 51, and every number holding the seventeenth place. But the second and third places being composite numbers, there remain only two places in which there can be prime numbers, that is, the place before, and the place after the product of 2 and 3, which is of course the sixth place. The same investigation might be carried on for a few numbers at the beginning of the series; but as every additional prime number adds an additional series, they soon become so numerous that they cannot be generalized.

A second principle may be deduced from the last figures of the number; but this depends upon the arithmetical scale, and applies only to 2 and 5, and their powers. If the number ends in either of them, that one will divide the number; or if any number of figures on the right can be divided by the same power of 2 or of 5, that power will divide the whole of the numbers. This is obvious; for all the figures to the left are a product of the same power of 10; and 10, being the product of 2 and 5, can be divided by either of them.

A third principle may be deduced from the figures of which the number is composed. Thus, if the sum of all the figures be divisible by 3 or 9, the whole number is divisible by the same; and if the sum of all the figures in the even places be equal to that of those in the odd, 11 will divide the number, whatever the individual figures may be.

The reasons of these are nearly self-evident. If any number of 10s be divided by 9, the remainder will be as many 1s; and thus equal remainders will be brought down to the end of the number, and so the whole will be divisible by 9. Whatever is divisible by 9, is also divisible by 3; but, as 9 is the second power of 3, it will not divide all numbers of which 3 is a divisor. In the second case, if any number of 10s are divided by 11, 1 will be required to be added to each 10 for every one in the quotient, and thus the figures in the odd and the even places will compensate each other, and have no remainder if their sum is the same.

A few other principles might be investigated; but the investigation would be difficult, and after all it would be of very partial use. There is one case, however, and that a very simple one, in which the principle is of very general use; and that is the case of 2 and

5, which are the factors of 10, or the powers of 2 and 5, which are the factors of the corresponding powers of 10. This is the principle by which we are enabled to ascertain where any fraction can or cannot be expressed decimally with perfect accuracy, and thus brought wholly into the scale of numbers. It is therefore the one most worthy the attention of the young student.

The *numerator*, which answers to the remainder in division, may be any number, prime or composite, because it is not the divisor in the process of reducing to a decimal; but if the *denominator*, which answers to the divisor, is a prime number, different from 2 or 5, or contains a prime factor, different from either of these, the fraction cannot be exactly expressed by a decimal. There is a limiting consideration here, however; for, if the numerator contains the same prime factors as the denominator, the fraction can be expressed in decimals; and therefore it is better, where the terms of fractions are large numbers, to reduce them to their lowest terms, before changing them to decimals. The method of doing this, as well as the principle on which it depends, will be explained afterwards. If the denominator is simply a power of 2 or 5, the decimal is found at once, by multiplying by the corresponding power of the other of these numbers. Thus, $\frac{4}{5}$ is $\frac{8}{10}$, or, in the decimal notation, ·8—the point on the left being the characteristic which distinguishes decimals from whole numbers.

But though a comparatively small number of the fractions which arise from arithmetical division or rational fractions—as we may term them, are exactly expressible in decimals, yet there is a law of succession in the quotient or decimal figures, which appears after the division has been carried on to a certain length; and when this law is once discovered, the quotient may, without any farther labour of division, be extended to any length that is required. If the denominator is a prime number, or the product of prime factors, this law of succession begins from the decimal point. But if it also contains 2 or 5 as a factor, there will be as many figures before the law of succession begins, as there are 0s in the power of 10, answering to the power of 2 or of 5, which is a factor of the denominator.

When the law of succession begins at the point, the decimal is called a *pure circulating* one, and when it does not begin till some places after the point, it is called a *mixed circulating* one. There is this difference between these, that the denominators of the circulating figures are 9s, and those of the terminate figures, answering to 2 and 5 in the divisor, are 10s; so that they are not addible quantities, as 1 in the one of them is not equal to 1 in the other; and in arithmetic, 1 and 1 will not make 2, unless the 1s are exactly equal.

It is easy to understand why the decimal answering to any fraction that has a prime denominator, must repeat a certain series of figures in one uniform order. When the figures which may happen to be in the numerator or dividend are all exhausted in the process of dividing, there is nothing to add to the remainders but 0s; the number of those remainders is therefore limited; for the remainder must be less than the divisor; and the number of numbers less than any given divisor, must be one less than the number which that divisor expresses. Thus, in dividing by 7, there can only be six remainders; in dividing by 19, there can only be eighteen; and so on in other cases. The number actually repeated or circulated, is, however, often much less than this, but no general law can be established by which the number of figures circulated can be determined beforehand; and the few cases in which this can be done, are nothing in comparison with the whole. If the denominator is 3 or 9, the decimal will repeat a single figure; for when 3 or 9 is employed in dividing any figure less than itself, the remainder is a repetition of that figure. If 11 is the denominator, the decimal will circulate two figures; and the sum of those two figures will in all cases be equal to 9, so that if one of them is 9, the other will be 0. This depends on the principle, that if any number of 10s be divided by 11, as many 1s will be wanted as there are 11s.

In this manner, rules might be investigated for finding the decimals circulated by other fractions having small prime denominators, but the labour of the investigation would be greater than any good that could be derived from it; and the same may be said of every arithmetical rule which applies to a single number only.

There is one class of numbers that, when less in value than 1, never circulate any number of figures; and thus they cannot be brought completely into the arithmetical scale, although approximations as near to their value as is necessary for any practical purpose can be obtained, and treated every way like common decimals. These approximations are especially convenient in surveying and engineering, as a few decimal places only are required in such operations; and there is this farther advantage, that operations by logarithms, which so much simplify what would otherwise be very abstruse cases, are expressed in decimals, and of course decimal arithmetic is the only form which can conveniently be used in case of them.

Every number which divides two or more numbers without remainder, is called a common *divisor* of them, and the greatest number that thus divides them is called their greatest common divisor; and when numbers have no common divisor, or are divided by common divisors until the quotients have no common divisor, they are called prime to each other. Numbers which have one or more common divisors are also called *equimultiples;* and the common divisor is also called the common multiplier. Though numbers are prime to each other, it does not follow that any of them is necessarily a prime number, for any of them may have any number of divisors of its own; and if these have not divisors of any of the others, the numbers are still prime to each other.

ARITHMETICAL OPERATIONS.

As the performance of these operations, though generally done according to empirical rules, and unaccompanied by any reasons or explanations, is the chief, if not the exclusive occupation of boys in the arithmetical classes of the common schools, we have no desire to send the student back again to perform anew the same heartless and unprofitable drudgery. On the contrary, we wish merely to explain, and that in as few words as possible, those matters which are, in the majority of cases, left without explanation.

Every arithmetical operation whatsoever must have for its object some change in the numerical value of that to which it is applied, for there is nothing connected with a simple number, that is, a number which merely expresses how few or how many, without any allusion to the nature or value of the things numbered. When it has such reference, it is called a *concrete* number; but operations with concrete numbers are applications of arithmetic, and not arithmetic itself.

There are only two modes of changing the value of a simple number—making it greater and making it less; but each of these

may be done in two ways:—First, the value of the number may be increased by putting to it another number, or other numbers, which have no reference to its own value. The operation by which this is accomplished is called addition; and in every case the result or sum is greater than any of the numbers added. Secondly, the value may be diminished by taking away any number or numbers that have no reference to the value of the number from which they are taken. The operation by which this is effected is called subtraction; and in arithmetic, the remainder left after subtraction is always less than the number from which the subtraction is made. In arithmetic, this number must be not less than all the numbers subtracted. If it be greater, there will be a remainder; if equal, 0 will remain; but if less, the case is arithmetically impossible, upon the simple principle that we cannot actually take away more than there is to be taken; but we can suppose more to be taken, and this gives us a new view of numbers, which can be better understood when we come to speak of Algebra, or the science of quantity considered generally.

Thirdly, a number may be increased or diminished according to some law, in which that number itself is the measure or standard. There are two operations by which this may be done: first, multiplication, or the finding of a number equal to a proposed number of times the given one. If the number expressing the times is an integer greater than 1, the product, or result of the multiplication, is as many times the multiplicand, or number multiplied, as there are 1s in the number expressing the times, that is, the multiplier, or multiplying number. But if the multiplier is a fraction less in value than 1, the product will be less in value than the multiplicand, in the same proportion. Fourthly, the same result may be obtained by division, the object of which is to find how often one given number, which is called the divisor, or dividing number, is contained in another given number, which is called the dividend, or number divided, or to be divided. If the divisor is greater than 1, the resulting number or quotient—which last means as many as may turn out, it being unknown till the operation is performed—must be less than the dividend; but if the divisor is a fraction of less value than 1, the quotient must be greater than the dividend. In common arithmetical cases, the multiplier and the divisor are generally numbers greater than 1; and thus multiplication is generally considered as a means of increasing, and division as a means of lessening, the values of numbers.

From what has been said, it must be obvious to any one who exercises even the slightest reflection, that addition and subtraction are the converse of each other, and so are multiplication and division; and that whatever is done by any one of them may be undone, and the given number or numbers restored to their original state, by performing the converse upon the result to the same extent. But when a little further reflection is exercised, it will appear that multiplication and division involve principles of a higher and more important nature than addition and subtraction. Addition and subtraction involve nothing further than the simple numerical values of the numbers added or subtracted; and there is no allusion to any relation or comparison of the entire value of any one number with that of any other. All the numbers are simply in terms of the arithmetical scale, and nothing more.

When, however, we come to multiplication, there is a relation between the multiplicand and the product; and the multiplier measures or expresses the value of this relation, namely, that the product is as many times the multiplicand as there are 1s in the multiplier. But in the case of simple numbers, the product is the same, and therefore it is of no consequence which factor we consider as multiplier or multiplicand; and consequently, the product expresses as many times either factor, as there are 1s in the other. So, also, in division, the quotient expresses the number of times that the divisor is contained in the dividend, or if there should be a remainder, and that end in an intermediate decimal, the quotient expresses an approximation to this number, which may be carried as near to the exact truth as possible.

Hence, both in multiplication and in division there is involved a doctrine much more important in itself, but also more puzzling to beginners, than anything connected with the mere values of the single numbers, and expressible in terms of the arithmetical scale.

It is this which forms the first stumbling-block in the path of the student of arithmetic in the common schools, and accompanies him throughout his progress, impeding him at every subsequent step.

The difficulty lies in the introduction of an idea of a new class, namely, one which is essentially intellectual, and to which there is no corresponding single substance or subject which can be named and thought of singly. It is true that simple or abstract numbers are not realities; they are, as it were, the invisible spirits of realities without the substantive bodies; although they are in so far embodied by their expression in the arithmetical figures, or their names in words, yet these are not sensible realities any more than the abstract ideas of the numbers themselves—but unfortunately, other parties besides schoolboys are apt to rest satisfied with the mere names, and thus neglect both the intellectual idea and the external reality. Still, however, it is by no means difficult to refer from the abstract idea of a number, to some reality which agrees with that number; and thus the idea, or intellectual conception, is as it were furnished with a substantive body, of which we can think as of a separate existence. Thus, for instance, if we think of the number 3, three pens, three books, or three something else, speedily comes to our minds as a reality, and brings the conception into the same class as our ordinary conceptions of the real existences, or beings, or things, which furnish and people the world around us.

But those ideas which the proper understanding of multiplication and division is the first to bring to the mind of the student in his arithmetical education, and indeed in his elementary education generally, cannot thus be reduced to any sensible type. They are not things of any kind, nor are they even abstract numbers,—they are simple comparisons of one number with another for the purpose of knowing the relations, or *ratios*, of these numbers. The doctrine of them is in itself remarkably simple; but as, without some explanation, there is nothing for the mind to lay hold of, beginners find it quite a puzzle; and as all explanation is but too frequently delayed till the student comes to the geometrical explanation of it in the Fifth Book of Euclid, which is far more difficult in form and expression than the arithmetical, or rather the algebraical explanation, the student rarely acquires any clear perception of it, and both student and teacher but too often pass over this Book of Euclid, as containing matter not to be understood.

Comparisons of all kinds involve the idea of a standard of comparison, as for instance, when we compare the length of one line with that of another, we use a foot, a yard, or some other measure, as a standard; and it is in terms of this standard that the comparison is made. In like manner, when we compare one number with another, some known number, of which the value is constant, or

the same in all cases, is used as a standard. The number 1 is the simplest number that we can use for this purpose, and hence, all arithmetical comparisons are made, and all arithmetical relations, or results of such comparisons, are understood to be expressed, in terms of the number 1. Thus, in multiplication, the multiplier or multiplying factor is compared with the number 1, and the result of the comparison is, that this factor contains the number 1 a certain number of times, integral or fractional, or a certain fraction of a time; and this number, which is shown by the mere expression of the factor itself, is the relation or ratio of that factor to the number 1 as a standard. Then we have another relation or ratio, one of the terms of which is given and the other not; but there are data, or means, sufficient for finding the unknown one. This unknown one is the product, or result of the multiplication; and what is required is, that it shall contain the other factor, that is, the factor not compared with the number 1, as often as the compared factor contains the number 1 itself. The multiplicand or number multiplied, and the product or result of the multiplication, are, therefore, equimultiples of the number 1 and the multiplicand; that is, they are products of them by the same multiplier.

In multiplication, if both factors are whole numbers, or fractions resolvable into terminate decimals, the product always admits of a definite and terminate expression: but if either or both of the factors are interminate decimals, the product may or may not be terminate, according as the interminate parts of the two factors do or do not extinguish each other; and this depends upon the nature of the particular case, and consequently does not admit of general explanation. In short, the object of multiplication is to find one term of a ratio, equal to another expression of, of course, the same ratio in different numbers; and is essentially the same as the common doctrine of proportion, or "Rule of Three" as it is called of the schools;—only, as the first term of the first ratio is always the number 1, no operation of division is necessary.

The idea of ratio involved in division is exactly the same, only it is reversed. Both terms of the first ratio are given in numbers different from 1, and 1 is the first term of the second ratio, of which the second term is the quotient or number sought. Hence, in division, the term which answers to the multiplier is always 1, and consequently no multiplication is required, just as in multiplication no division is required in consequence of the term answering to the divisor being 1. If, however, we were to take, or have given us, any number different from 1, as the standard of comparison in that ratio of which both the terms were given, we should be brought exactly to the practice of the common Rule of Three, and have both to multiply and divide. But then, notwithstanding this difference in the practice, the principle is exactly the same: we have the two terms of a ratio given, and one term of the same ratio expressed in a different number, to find the other term agreeing with that expression.

In the case of equal ratios, it follows from what has been said, that they are equimultiples of the very simplest terms in which that ratio can be expressed,—1 being one term, if the other term of the ratio can be expressed in an integer number.

In performing the operative or mechanical part of these four fundamental processes in arithmetic, we have only to bear in mind, that when we add or subtract, 1 in the one number must be equal to 1 in the other; or, in other words, they must, when simple or abstract numbers, occupy the same places in the scale. In the performing of subtraction, there is one small matter which sometimes occasions a little difficulty to beginners, and that is what is called "borrowing 10, or by 10s." For instance, if we come to 5 in the number we are subtracting, and find only 3 in the number we are subtracting it from, we add 10 to the 3, or call it 13, and subtract the 5 from that. Then, by way of compensation, we call the next figure to the left, which we have to subtract, 1 greater than it really is, and when our operation is completed, we find that the difference of the numbers is perfectly correct. The explanation why it should be so, is exceedingly simple. In the first place, if we add to each of any two numbers which have a difference, exactly the same number, we increase the sum of each, but we neither increase nor diminish the difference; for as the same number has no difference from itself, and equal numbers have also no difference, we may, in seeking the difference of any two unequal numbers, add to them or subtract from them any equal numbers that we please. The fact is, that subtraction is nothing but taking away from both numbers that one which we wish to subtract, and 0 remains of it, while the difference remains of the other one. In the second place, 10 in any place of the arithmetical scale, are equal to 1 in the next place to your left hand; and therefore, when you add 10 to any figure of a number, and 1 to the next left-hand figure of another number, you add exactly the same to both, and therefore do not in anywise make the difference of the two numbers either greater or less. It would be the same in the case of subtracting equal numbers of them; and therefore it is a general principle, that the addition or subtraction of numbers which have no difference, neither increases nor diminishes the difference of the numbers to which they are added or from which they are subtracted. Indeed, this is a general principle, applicable to all subjects whatsoever; as, for instance, the difference of the length of two lines will remain the same, to whatever extent you may increase them or diminish them, provided the increase or the diminution is the same in both.

We have already hinted at the wonderful extent to which the scale of numbers simplifies the performance of the operations; but in order to understand this fully, we must attend to both values of numbers in the scale, that is, to the original value of each figure, as depending on its form, and its value in arrangement as depending on its place,—that is, its distance to the left of the units, if an integer; and its distance to the right of the separating point, if a decimal.

In addition and subtraction the second of these operations is barely, if at all, perceived; because the mechanical arrangement of numbers to be added or subtracted, so that the same places in them all shall be in columns from the top downwards, does not require any particular attention to the places of the single figures. One thing however we must attend to: If the given numbers, or any of them, consist both of integral places and decimal places, the decimal or separating points must be ranged under each other; and this arrangement will bring all the figures, whether integral or decimal, into their right places.

In multiplication and division there is something more than this to be attended to; and that something gives us a hint to a view, though a very distant and obscure one, of a kind of numbers whereof we have not yet treated. Thus, in multiplication, the product of any figure of the multiplicand by any figure of the multiplier is a definite number, of which we have to acquire the knowledge by absolute counting,—for instance, if the one figure is 7 and the other 6, the product is 42, in what two places soever the figures expressing this number may stand. The real place of any part of a number considered in this way is that of its right-hand figure; and thus, the

second inquiry as to the place which the product of any two figures shall occupy in the general product of two numbers, each consisting of several figures, is the place of its right hand-one. In a simple number, and without any reference to multiplication, the distance of the place for the units determines the value of place; and this consists of as many multiplyings by 10 as there are intermediate places. In multiplication, we have to take this into consideration for the figure in each factor; and as the value of place of both these is determined in the same way, we have this principle,—the right hand figure of the product of any two figures, in a case of multiplication, must be as far to the left of the units of the general product as the sum of the distances of the figures multiplied are from the units of the several lines, or particular numbers, of which they form part. It must be understood that these distances from the units express numbers of times multiplication by 10, and if we were to express them separately by figures, the sum of those figures would express the product of the corresponding numbers; and as division is the converse of multiplication, the difference of two of those peculiar numbers there, would express the quotient of the corresponding numbers. Therefore, there are numbers, the addition of which answers the same purpose as multiplication, and the subtraction of which answers the same purpose as division. Consequently, if we could use such numbers instead of the common numbers in the scale, we should get rid of the laborious operations of multiplying and dividing, by substituting in their stead the far more simple ones of adding and subtracting. There are such numbers; and they are termed *exponential* numbers, or *Logarithms;* but, as they require more explanation than we have room for in this lesson, we must defer them to a future one.

The saving of time and labour which the mere scale of numbers enables us to make in the operations of arithmetic, is so great, that we may give one instance of it: suppose it was required of us to multiply 998 by 999, the operation without the scale would be the actual counting of 998 998 times over, which is, in fact, the counting of 996,004. Admitting that 90 numbers could be counted in a minute, which is more than any one could continue to do, 10,000 minutes would be required for the operation, which is nearly 480 hours, or 40 days, at 12 hours constant counting every day.

Now mark with what simplicity the same result is arrived at by means of the scale of arithmetic. A thousand times any number is that number with three 0s on the right of it; and consequently a thousand times 998, is 998,000. This is one time more than is wanted; and we at once take this away by simple subtraction: thus:—

From	998,000
Subtract	998
Remains	997,002, the Product

Which is all the operation required, and may be performed in two minutes, or even less.

In consequence of the scale, we never have a single number of more than 9 to add at once, of more than 10 to subtract at once, or a single product of more than 9 times 9, to contemplate in multiplication or division, and this reduces all our elementary operations in arithmetic to very simple matters.

The solution of every arithmetical question or problem, whether simple or complicated, consists in the performance of these elementary operations, in the order of certain laws derived from the nature of the problems themselves, and thus varying with the nature of these. This must be learned from knowledge of the problem or question itself, and is an application of arithmetic in which the student or the man of practice must exercise a sound judgment, inasmuch as there is nothing in mere arithmetic itself to guide him in his decision. This is, indeed, the case in the applications of all the sciences by the engineer, the architect, or the surveyor,—their own judgment must find out the mode of application; for the science itself, however highly it may rank as a science, can give them no assistance here.

In many complicated problems, it is desirable to see all the operations arranged in their proper order before one of them is performed, because we can thus judge better whether they are right or not, and because it frequently happens, that among the operations, if they are many, there may be one or more which exactly compensate each other, and thus may be left out altogether. To take a simple instance, one operation may be a multiplication by 12, and another a division by 12, both of which may be left out without affecting the result.

In order to form this skeleton of the operation properly, it is necessary that the simple operations should be expressed by signs or characters devoted to that purpose, just as numbers themselves are denoted by the common arithmetical figures. The signs thus used for the operations are as follows:—

+ Is the sign of addition, and is called *plus*, or more, because the sum of the numbers among which it is placed is more than it otherwise would be, by every number having + before it.

− Is the sign of subtraction, and is called *minus*, or less, because every number having − before it makes the sum of the other numbers, among which it appears, of less value than it otherwise would be.

× Is the sign of multiplication, and points out that every number before which it is placed is to be used as a multiplier.

÷ Is the sum of division, and always shows that the number before which it is placed is a divisor.

: Is the sign of a relation, and consists of part of the sign of division without the other part, as showing the operation of dividing is not performed. Division is also indicated by writing the dividend above the line, and the divisor below the same, and there are cases in which this is the best mode of expression.

= Is the sign of equality, and it is required in arithmetic only when the equal numbers are differently expressed: thus, there is no use in such an expression as $6=6$, because the equality is obvious at first sight; but the equality of $7+4-5=6$, though equally true, is not so obvious to a beginner; and therefore the use of the sign becomes necessary even in elementary expressions.

> Is the sign of inequality, in cases where the difference is not required, the open end of the sign being placed toward the greater number, and the close toward the less.

When several numbers connected by signs are considered as one number, and are followed, especially by a sign of multiplication or of division, they are enclosed within parentheses, which parentheses are the sign of one entire number taken as a whole, in how many parts soever that whole may be expressed, and by what signs soever the several parts may be connected. There are one or two more signs than those explained occasionally introduced, but as these relate chiefly to exponential numbers, they would be better delayed till we come to consider them.

We shall conclude this lesson with the explanation of a problem, which, though commonly made part of the arithmetic of fractions, is of general use in the simplification of arithmetical operations, and

there are deducible from it some principles of a higher order, which are not required in explaining the common principles and practice of arithmetic.

PROBLEM. *To find the greatest common divisor or measure of any two measures.*

If the numbers are prime to each other, they have of course no common divisor or measure; and therefore the labour of seeking for one leads to no result that can be applied to any useful purpose. Still, however, this labour is not wholly in vain; for there are no means of knowing, but by actual trial, whether two numbers are prime to each other or not; and the method used in the solution of this problem, is the only means of trial.

The principles are these: if any number is a common divisor of any two numbers, it is a common divisor of their sum, their difference, or of any multiple of them, or of their sum or difference. These principles are so nearly self-evident, as hardly to require or even to admit of demonstration, and the operation itself is best understood by means of an example. We shall take a short one, that is, one consisting of small numbers, at random; and apply to it the ordinary rule, which is this: Divide the greater number by the less, and the divisor by the remainder, until nothing remains. The last divisor, if greater than 1, is the greatest common divisor or measure. It cannot in ordinary cases be less than 1; and if it is just 1, the given numbers are prime to each other: It is required to find the greatest common divisor or measure of 279 and 303. The operation is as follows:—

```
279)303(
  279
  ---
24)279(11
  24
  --
  39
  24
  --
15)24(1
  15
  --
 9)15(1
   9
   -
 6)9(1
   6
   -
3)6(2
  6
  -
```

Greatest common divisor

3 is a divisor of both numbers; for it divides 6, which is twice 3; 9, which is the sum of 6 and 3; 15, which is the sum of 6 and 9; 24, which is the sum of 15 and 9; 264, which is a multiple of 24 by 11; 279, which is the sum of 264 and 15; and 303, which is the sum of 279 and 24; and 279 and 303 are the two given numbers whose measure was sought. But 3 is also the greatest common divisor, for no greater number will divide 6, 9, 15, 24, 279, and 303; therefore, what has been required is found, and the operation is right. The principal use of this problem is the finding of the smallest terms, both whole numbers, in which any given ratio can be expressed, or whether that ratio does not admit of simpler terms than those of which it is given.

This lesson still consists of the simple parts of arithmetic; but we recommend it to the careful perusal and study of every one who wishes to make himself thoroughly master of the science of numbers.

MORSELS OF CRITICISM, OR NOTES ON BUILDINGS.

NO. II.

1. IT sometimes happens—more frequently, indeed, than is suspected—that a good idea may be detected in what is else exceedingly poor, and where it is almost thrown away. Happy, therefore, those who have penetration enough to discover such rough jewels, and skill enough to be able to polish them up, and set them off to every advantage. Plagiarisms of that kind are truly laudable, and withal exceedingly safe, for there is very little danger of their ever being found out. Though not exactly a case in point, we may refer to a building erected not very many years ago, which, although of most common-place character taken as a whole, and very faulty besides in many respects, offers an unique example in its columns, no less tasteful than singular. Nevertheless it has oddly enough happened that that structure,—which is certainly one of considerable pretension,—has scarcely obtained any notice whatever, either for commendation or the contrary;—except, indeed, in 'Jones's London in the 19th Century,' where Mr. Elmes (himself an architect) is pleased to say that "the whole edifice is a chaste and pleasing composition," yet bestows not a word upon what is most remarkable in it, the very peculiar details and character of the columns! The only mention we have seen relative to them, is in the article '*Civil Architecture*' in the Penny Cyclopædia, where it is added, "as far as the columns alone go, that portico is exceedingly well worth notice."—Truly it is the columns *alone* which possess any merit of design, for even their entablature does not partake of it, both that and the pediment being most wofully naked, bare, and unfinished, so that one might fancy either that the columns had been brought from some other edifice, or that all the rest was by some other hand. Perhaps, the former idea of the two is the more likely to suggest itself, because there is very little taste shewn in the disposition of the columns, the intercolumniation being poor and straggling. Unless its length could have been reduced, the portico should have been octastyle, instead of hexastyle; in which case the inter-columns would have been well proportioned. Another circumstance which produces a disagreeable effect, is that of there being three large doors of similar dimensions and design within the portico; which gives a strange air of general disproportion to the whole. The columns themselves, however, are quite an architectural study; the capitals are a pleasing and little-known variety of the Athenian Ionic, composed after one which is conjectured to have belonged to the temple of Eucleia on the Ilyssus. The profile of the bases is also very peculiar, nor easily to be described without a section; but the most remarkable peculiarity of all is, the mode of fluting adopted for the shafts,—though fluting it can hardly be called, for *striating* would be a more suitable term for what is so distinct from the usual mode of deep channels and wide fillets. The character, therefore, becomes something between that of a plain and that of a fluted or channelled shaft: on which account it ought to recommend itself as one source of that greatly needed quality, variety in detail. After what we have said, perhaps some will be curious to learn where this specimen—we will not say of a Grecian Ionic order, but of the columns of one—is to be met with

and accordingly refer them to the church in Regent Square, Gray's Inn Road.

2. The very common error of inattention to consistency of design has already been animadverted upon in our remarks on the entrance to the Princess's Theatre, Oxford Street; and akin to that vice is the offensive paltriness of not keeping up the character of a front at the ends or returns of a building, where, owing to its greater loftiness, the upper part of those ends is visible above the adjoining houses. In such cases, one is tempted to imagine that the architect has not bestowed a thought on the exterior, beyond the mere geometrical elevation of the front—where the defect alluded to, of course, does not betray itself—or else that he prepared his design without ascertaining whether his building would overtop its neighbours, and thereby display more than was intended to be seen. That such inconsistencies should be committed at the present day is the less excusable, because they have been more than once held up to reprobation, and we must therefore conclude that those who so offend either do not trouble themselves to read criticism, or are else either too sulky or too stupid to benefit by it. Among those who consider criticism to be sheer impertinence, and shun it accordingly, we may place the architect of the quondam City of London Tavern, now the Wesleyan Missionary Hall, Bishopsgate Street, the front of which has a great deal of pretension, and yet plainly enough shows itself to be a mere mask, the cornice stopping just at the angles, instead of being continued along the returns or ends of the building, even for the distance of a few feet. This is assuredly a very trumpery kind of economy, if economy it can be called at all, because the saving in regard to expense is a mere trifle, while the effect is not only unsightly, but the spectator is disagreeably convinced that, notwithstanding the showiness with which the mere front is decked out, there is no little also of either poverty or stinginess and meanness. If retrenchment was to be the order of the day, infinitely better would it have been had the architect dispensed with the columns, since they cause the front to appear too much squeezed up, there being barely space enough between them for the windows. Had he *economized* by omitting them, he might then have afforded not only to continue the cornice and finish the ends of the upper part of the building, but also to impart more character to the basement, which is now in rather too trivial a taste, and has only a few horizontal scorings by way of apology for rustics.

3. The mean and faulty system of rustication, instanced above, detracts very materially indeed from the architectural character of Goldsmiths' Hall; which is all the more to be regretted, because that building is in some respects a noble structure, and has an air of considerable dignity, although not altogether in the very best taste. Yet it might easily have been rendered very superior to what it now is, had it but been treated consistently and uniformly. Instead of which, although there is only a single large order, the two floors and mezzanine included in it are so exceedingly different, that the upper and lower halves of the design form a remarkably strong contrast to each other, the windows of the upper floor being decorated in an unusual degree, while those of the lower ones have no dressings whatever!—but by way of excuse, we presume, for such omission, the face of the wall has there a few horizontal stripes, so broad and shallow, as even in that respect to produce the reverse of boldness. The consequence is that all unity is sacrificed, and the expression of one part quite contradicts that of another. That the second windows, as being those of the principal floor, should be accordingly made principal in the design, and be more embellished than the lower ones, is not disputed; but that these last—which do not form a subordinate portion or basement, but are included within the same order as the others—should be left totally naked, without the slightest kind of framing or bordering to them, is a most unwarrantable solecism; and is not only agains tall rules, but against all principle—against every notion of consistency and propriety. It is warranted neither by the Italian style, nor by Italian practice. Let us imagine the ground-floor of either the Travellers' or Reform Club-house to have such windows; the whole façade would at once be changed, all keeping in it entirely destroyed. The utter disregard of keeping—a term which our architects have not yet adopted, and of which very few among them seem to understand the meaning—nearly destroys, at least neutralizes, all other merit in the exterior of Goldsmiths' Hall.

LETTER FROM AN ARTIST, ON MR. GODWIN'S SCHEME.

SIR,

A MORE arrant piece of humbug than Mr. Godwin's scheme for establishing "A British Association for the advancement of the Fine Arts," has scarcely ever been attempted to be foisted upon the public; and although he is connected with *Art Unions*, that gentleman must entertain very extraordinary notions of art, if he really imagines that his plan is calculated in the slightest degree to advance it, or to promote its real interests. Can he be in earnest, or is he merely quizzing, when he talks of "whole towns being inoculated" with a love of art, by no other process than the very *simple* one of annual meetings, where artists of all classes should assemble for a day or two—to do what?—or serve whom,—except indeed hotels and lodging houses? So then, he would really recommend us to try the experiment of getting up a kind of yearly Bartholomew Fair for art and artists!—and no doubt there are some folks who might find their account in such things, to wit, those bustling busybodies who are ready to thrust themselves forward on all occasions. But surely such character is not that of the followers of art generally—at all events, it is not that of true artists, who would feel themselves and their art degraded were they even in any way to countenance such mountebank assemblies.

It might be supposed that the various annual exhibitions in the metropolis and in other towns, are infinitely better calculated to diffuse a taste for art among the public; or if they are found to be by no means so effective in reality, as they ought to be according to theory, what possible result for good can be looked forward to from Mr. Godwin's *magnificent* scheme for annual congregatings and *how d'ye-doings* of the artists of Great Britain? If indeed art and the love of art could be acquired by mere talking and gossiping, then indeed, there would be something plausible in what he proposes; but unfortunately art is not to be so learnt, or so taught; or rather, quite the contrary is the case, for I have generally found that the greatest chatterers about art, are precisely those who are most deficient in a genuine feeling for it.

In making these remarks, I must be understood as intending no reflections upon the "British Association for the Promotion of Science," because, as I have taken no interest in its proceedings, I am utterly unable to give any opinion relative to it. I will therefore only remark, that the case of science and that of art are altogether different. Geologists, chemists, and other scientific

students may communicate exceedingly important facts and discoveries, or other results of their inquiries in their respective branches of knowledge; but I really do not see what an artist or a poet—and Mr. G.'s scheme embraces *poetry!*—can have to communicate. Are poets to recite compositions that booksellers will not publish, or which, if published, the public will not read? If not, what could the bards have to do at such meetings?

I might point out other palpable absurdities in Mr. Godwin's scheme,—which, by the bye, he has so industriously circulated among the periodicals,—but desist. He is, I believe, a very young man, and fond of making himself conspicuous at the meetings of the Institute, and wherever else he can; but in attempting to cut a figure before the public, he really should be a little more cautious, or else he may chance to get up one morning, and find himself not exactly 'famous,' as Byron did; but celebrated after a somewhat different fashion, with the unlucky initials C.A. affixed to his name, like a tin canister to a dog's tail; and no doubt you and every one else will understand me when I explain those letters as the initials of—*Charlotte Ann*.

Whatever my brother artists may do, I protest against the proposed association as truly degrading to art,—as tending only to collect together the bob-tail and rag-tail who *trade* in it,—and as calculated to keep aloof all those who exercise it worthily, and who must look with thorough scorn upon all such contemptible quackery and mountebankery.

I remain, Sir,

AN ARTIST.

COMPETITION PREMIUMS AND DESIGNS.

TO THE EDITOR.

SIR,

THAT there is a very great deal of apathy in regard to architectural matters, can hardly be disputed; nor is that apathy confined to the public alone, but unfortunately extends to quarters, where we should expect to meet with its direct reverse. Were other proof of such being the case wanting, we have it in the sudden and complete silence which succeeds to the stir occasionally produced by an architectural competition, or something of that nature. However, I do not intend now to enter upon a question which would demand a somewhat lengthy inquiry into it, but will merely suggest what I conceive would prove a very wholesome regulation as regards competition designs; which is, that every design which has obtained a premium at a public competition, should be expected to be exhibited the following season at the Royal Academy. An opportunity would then be afforded to the profession and others, of seeing and judging of many works that are now—I know not why—industriously kept out of the reach of criticism, till criticism is comparatively unavailing. There is a very strong case in point just now, in which the application of the principle recommended might have a salutary effect. I allude to St. George's Hall, and the Assize Courts, Liverpool, for both which Mr. Elmes jun.'s designs obtained the first premium. It is to be hoped that those designs will be to be seen at the forthcoming Royal Academy exhibition, their appearance there being no more than a duty on the part of Mr. E. towards those who selected them. I will not indeed say that there can be no reason for withholding them from public view, because reasons there may be, and those exceedingly strong and cogent ones, but of such kind that they cannot be admitted without actually confessing that although those designs found favour at the respective competitions, it would be exceedingly hazardous to expose them to the ordeal of a public exhibition in the metropolis. I have just learnt that Mr. Elmes has proved equally fortunate in obtaining a third building of some importance in the same place, being informed that its cost will be about £18,000; surely then, it is not unreasonable to ask to be furnished with some evidence of that gentleman's talents, in order to judge whether they bear any proportion to his very singular success. I need not be told that it is entirely optional on the part of any one whether he sends designs to the Royal Academy or not. Still some such regulation as that I have pointed out might be established, did the Institute choose to take up the matter, and earnestly recommend such exhibition of all premiumed competition designs, making it imperative in the case of its own members, and strongly urging the necessity of it upon the profession generally, and competition committees. But it has been asked before now, what has the Institute hitherto done at all—what single beneficial plan of any kind has originated since its establishment? If any one can tell, I wish he would divulge the *secret* pro bono publico.

I remain, &c.,

ZERO.

SAFETY HARBOUR AT LOWESTOFF.

TO THE EDITOR.

SIR,

ENCOURAGED by your invitation to write again to you on the plan of a safety harbour at Lowestoff, now more than ever needed, I avail myself of the opportunity thus afforded, to state somewhat more on that very interesting subject.

So obvious was it to commercial men, that such a harbour was much needed, for preservation both of life and property, that a company was formed, as I before said, about 15 years since, for constructing a harbour of refuge at Lowestoff for ships in stress of weather, and for opening the navigation from Lowestoff to Norwich, and enabling vessels to proceed direct to all places depending on that navigation; the town of Beccles forming a very important feature therein.

That Company commenced operations under the authority of an Act of Parliament, 7th and 8th George IV. chap. 42, which was afterwards amended by another Act, 2nd William IV. chap. 2, whereby ample powers were vested in them for the purchase of lands, making cuts, erection of locks and bridges, deepening the rivers Wavenay and Yare, and forming the harbour of refuge; the powers of which respective Acts of Parliament, it is considered, can still be rendered available for all the purposes required by the proposed new company.

The necessary lands were purchased, a cut was made from the open sea to Lake Lothing, then intended to have been made the harbour of refuge; and other cuts were also made, and the rivers Wavenay and Yare deepened and widened, where it was found necessary, from Lowestoff to Norwich and Beccles. The navigation from London, Newcastle, Stockton, and other ports, has been carried on by regular traders, direct, without transhipment, which is of so much importance in a traffic consisting chiefly of coals and grain. The buildings which were erected, the great sea lock and others, a dredging machine in perfect repair, and the steam engines now in use, were recently valued at above £15,000, independently of the property in the land, harbour, and navigation of the rivers to Norwich and Beccles.

The tolls received from vessels using the *navigation* only, imperfect as it still remains, have realized on an average, for the last nine years, upwards of £1,700 per annum.

The tolls and dues paid at Yarmouth are estimated at from 14 to £15,000 per annum, and two thirds of this sum, say about £10,000 per annum, is levied on goods destined for Norwich, Beccles, and the vicinity. About 2000 tons of coals and timber are entered for Norwich weekly, the greater portion whereof would be brought by Lowestoff, if efficient steam tugs were employed on the navigation; at 2*s*. per ton, on 1500 tons only, instead of 2000 tons, the weekly income would realize £150, or £7,800 per annum; now this cannot be called a conjecture,—it must be a certainty.

It had been found, after mature consideration, that the harbour should be at Lowestoff, and that by carrying out the piers below low-water-mark, a sufficient depth of water would be obtained to enable vessels to enter at all times. Now it must be self-evident to every man of common sense, that, unless this great point were accomplished, neither public nor private adventurers could reap the benefits contemplated by the originators of the plan. Vessels in distress have no choice of tides, and are safer in the open sea than in a fruitless attempt to gain a harbour unfitted to receive them. How different the case, then, when at no period of the tide could an entrance be denied them, and when the farther they proceeded towards Lake Lothing, the safer would they be, and the more commodiously accommodated. This then is now the prominent and leading object of the new company.

It has been ascertained that the extension of the south pier for about 170 feet only, would give a considerable increase of depth at low water, but more or less according to the operation of the tides, and that only to be ascertained with any degree of certainty as the works proceed. It may well be asked, however, what are 170 feet in a work of this sort, or twice that amount, if we can go beyond low-water-mark, and thereby ensure at all times water sufficient to answer every purpose of ingress under all circumstances and at all times. This object once attained, what are the results? There can be but one opinion, and that in favour of the undertaking. One trader in Norwich states that, were vessels enabled to reach Norwich all tides, the saving to *him alone* would be upwards of £500 per annum. In order to form a comparison as to the charges on goods sent viâ Yarmouth, and those forwarded by the Norwich and Lowestoff navigation, the following table may not prove uninteresting.

Charges on 500 quarters of barley shipped at Yarmouth would be as under:—

	£	*s*.	*d*.
Wherry freight from Norwich	6	5	0
Charges at Yarmouth for measuring	3	6	8
Dues	2	10	0
Total charges at Yarmouth	12	1	8
The same shipped at Norwich and forwarded viâ Lowestoff, would be only	4	0	0
In favour of Lowestoff	8	1	8

It is upon public grounds that I have trespassed so much on your time and patience. Every vessel saved is a public as well as a private advantage. Every life preserved is a blessing to the community at large, as well to the families and friends of individuals and to the individuals themselves. In this now useful undertaking, fraught with such distinguished benefit, public and private, I would again invite the friends of humanity to join their aid in carrying it fully and speedily into operation. Very little capital is now needed, no risk incurred, and, as I have shown, large profits indeed to be secured in a very short period on the completion of the harbour alone, besides what will be afterwards derived from the improvement of the navigation, which does not now so much press on public attention.

Your obedient servant,

16 *March*, 1841. J. J. B.

INSTITUTION OF CIVIL ENGINEERS.

We lay before our readers two very important documents which have been put forth by this Association:—1. The President's speech on opening the session for 1841; and 2. Report of the council for 1841.

We give precedence to the speech on account of the high quarter from which it emanates, as well as for the important matter which such a speech is expected to contain. The speech gives a very narrow view of engineering, and thence draws certain lugubrious conclusions, which must damp the ardour of students, and do injury to that profession, of which the President ought *ex officio* to be the chief promoter. But we shall take another and an early opportunity of offering a few remarks on the subject; and so, in the meantime, we recommend the speech to the perusal of our readers; the Institution is highly respectable, and the keeping of it up is a just tribute to the memory of Mr. Telford, but for whom it might never have existed: still, it must not be suffered to ride on the profession, like the Old Man of the Sea on Sinbad the Sailor.

The subjects for Telford premiums [See No. xiii. p. 21,] are well chosen; and if the results are fairly worked out and given to the public, instead of being mewed up in the pigeon-holes of the Institution, they would do good. Exclusiveism is the bane of many things; but in engineering it is a perfect nuisance.

The report contains what reports generally contain. There is one part of the obituary with which it closes, that gives us very great satisfaction,—the notice of the late Mr. John Oldham. He was a man without a complete parallel. Mr. Samuel Lover goes a considerable way. Both have social powers which are (no, alas, *were* in the case of one of them) quite electrifying; and yet neither was carried away by those powers to the neglect of more important matters. Both were excellent miniature painters, and had soul as well as colour in their pencils. Here the parallel ends: Lover's other avocations are literature, music, and poesy. Oldham devoted himself to the prevention of forgery in bank-notes; and thereby did inestimable service, first in Ireland and then in England.

ADDRESS OF THE PRESIDENT.

Hitherto the increased number of our Members, and the attendance at the meetings during each year, have been commensurate with the growing importance of the Institution, and I have little doubt of the success of the present Session being still greater. We have under consideration several interesting subjects, to which some of our most active Members have paid great attention, and in which they have made important discoveries—these will form the ground-work of interesting and instructive conversation, or even, to use the language of a greater assembly, of 'debate,' but I trust that our discussions will continue to be conducted, as heretofore, with that good temper which makes even *debate* delightful, when the attainment of truth is the sole object. Truth will not bend one

inch out of its right line, to accommodate false theory. He who tells us, that he "lost his patience when works were censured not as bad but as new," might be a very good poet, but in this respect at least he was no philosopher. One of our Vice-Presidents has presented me, within a few days, with a report on the best mode of improving one of our great navigable rivers: this report contains observations tending to level with the dust much that has been said by, I believe, all other engineers, on the importance of tidal back-water. I know from experience that many theories which have, through their novelty or otherwise, appeared startling on the first view, have proved to be founded on truth, and have therefore superseded the old-fashioned notions. No class of men can be more devoted or bigoted to their opinions, than the Aristotelian philosophers were to their doctrine of syllogisms and *à priori* theories, which, though it had the authority of ages and names, was obliged to yield to the once-despised and even persecuted inductive philosophy of Bacon. Although, therefore, some engineers may not coincide with the views expressed by our Vice-President, we shall do much good by examining impartially into the deductions he has drawn, at the same time carefully avoiding all personal considerations. A distinguished English essayist, after remarking that nothing denotes a great mind more than the abhorrence of envy and detraction, states, that the best poets of the same age have always lived on terms of the greatest friendship; and surely if this is the case with poets, who draw much upon imagination, Engineers, who have to deal with science and with facts, have less apology for excited feelings.

Without seeking in the recollections of a bygone generation for comparisons, we may congratulate ourselves that, although the number of Engineers has much increased, we are, I trust, without exception, *friends;* and I consider that our intimacy has been materially assisted by this Institution, where we have met, compared opinions, and rubbed off the sharp angles of professional jealousy or emulation, if any such existed.

Another valuable Member of the Council has, he conceives, discovered the true theory of the action of steam in the Cornish Single Pumping Engines, by which he accounts for their extraordinary economy. This theory, which is equally novel and ingenious, is now subjected to your examination and criticism, and I am sure that my friend Mr. Parkes would feel disappointed if his discovery were not to be submitted to that ordeal, in common with every similar subject of importance which is brought under the notice of the Institution.

While I congratulate the Institution on the increase of its Members, I ought at the same time to express my opinion, that from the number of young gentlemen who within the last ten years have studied for, or have entered the profession, the supply is likely to be at the least equal to the demand; and to caution those who intend entering or are now studying for it, against confining themselves to the strictly professional part of the usual routine of education.

The Railways, both during the preliminary surveys and in their subsequent construction and management, in addition to other works of Engineering, have given employment to many. But the principal towns are already connected by Railways, or Engineers and Surveyors are now employed in projecting or executing lines where they are yet wanted. Is then the demand for professional gentlemen likely to *increase?* Is it not likely rather to *decrease?* Now certainly the number of Engineers or Students for Engineering is increasing. If we look at the number of students in the classes for Civil Engineering at the different Universities and Academies; the Universities of Edinburgh and of Durham; King's College, University College, and the College for Civil Engineers in London; we are led to ask, will this country find employment for all these? I freely confess that I doubt it. My object in what I have here said is, not to deter those who may already have resolved and have taken measures to follow the profession, but to advise them not to depend on this country alone, and so to direct their studies as to fit them for other countries also, where the field is not large enough to support men who are strictly and exclusively professional. For such, great countries only can find employment, and other great countries are educating their own Engineers. To be fitted for going abroad to any part of the world, a man must be a tradesman as well as an Engineer; he must furnish his *hands* as well as his *head*—and if he know more trades than one, so much the better; for he may have to direct in *all*, but *one* he ought to know thoroughly. Thus stored, all the world is open to him, and with the formation of new continents and colonies, and the improvement in the old ones, the Engineer may insure independence. Not only in such countries, but at home also, his experience as a workman will prove his best friend and assistant in raising him to eminence, and make him feel that confidence in his own resources which has enabled so many engineers, whose name and fame stand high in the annals of the profession, to raise themselves from the millwright, stone-mason, and carpenter, to the highest grade. As a strong corroboration of the system which I recommend, you will observe the practical education given by each of these individuals to those of their family who are intended to succeed them. Let it not be supposed that I would undervalue the importance of science or of a scientific education, which is as essential to the Engineer as the knowledge of the principles of navigation is to the naval officer, but that I earnestly recommend *practice* also.

I hope to be excused this digression, but the great number of young gentlemen who, having been bred in Engineers' offices, apply to me for employment, which I cannot give them, or to be admitted as apprentices when I cannot in justice receive them, makes me feel very sensibly the importance of these remarks, and that it is almost a duty to give this publicity to my opinion.

To return to the Institution; I hope the attendance at the ordinary Meetings will be even better than that of last Session—that the Secretary's list, which is regularly posted up, will have still a greater number of bright spots and a smaller number of black marks opposite the names of the Council, as well as of the Members, Graduates, and Associates generally. I do not name this as a complaint, for the attendance has hitherto gone on improving, that of the Council influencing the Members.

I have lately referred to the very great, and I fear, increasing number of debts due to the Institution from Members and Associates, and still more from Graduates who were elected under a promise to send in an original communication or drawing, and I hope that the present Session will show a great reduction in the amount of these engagements. The fear of not producing something of sufficient value operates probably to overcome the desire which every gentleman, having made a promise, must feel in redeeming it. As an encouragement, let me refer such persons to the contributions by Graduates during the last Session; they will find that some of them required little inventive genius, but only the ability to record correctly what they have noticed on the public works in which they have been engaged, or which they have visited. To some of these, the Council have awarded premiums, and they esteem them valuable as recording details of works taken from measurements at the time of execution, thus forming an addition to our records, and making the Institution a deposit of "*works done,*" which is one of its important uses; and I think no Engineer intrusted with public works would prevent Graduates having the opportunity of doing this for their own improvement, and for the benefit of the Institution.

The subjects for these papers, models, and drawings, are numerous,—I may almost say, innumerable. Of many of the great national manufactures of this country we have as yet no records in our possession, and until we possess them our stores will be imperfect. As an Encyclopædia gives a definition and general description of every art, so should our Institution possess an original history, and drawings or models, as well as books, treating of every machine and manufacture connected with our profession.

Members of the Council during the last Session contributed liberally in books, and have set an example to the present Council. As a guide or specimen of the nature of the desired communications, the subjects for the Telford premiums have been varied and enlarged, but it is not to be understood that the subjects therein stated are to occupy exclusively the attention of Candidates, even for the Telford premiums. By thus enlarging the subjects and inviting papers, we may, I hope, look for an increased number of valuable communications, which it may press upon the Telford Fund to do justice to; I have therefore informed the Council that I have appropriated the interest of One Thousand Pounds, 3 per cent. Government securities, or Thirty Pounds per annum, which I request the Institution to accept, as my Annual Donation, to be applied as may appear best suited for the objects to which I have referred, or for other purposes conducive to the benefit of the Institution.

ANNUAL REPORT OF THE COUNCIL.

The principal duty of the Council, in the year now past, has been to carry out and persevere in the practice and regulations established during previous years, which have been found to contribute so much to the rapid growth and increasing value of the Institution.

But, though the past year may not have been marked by extensive changes, or by the introduction of new regulations, it has been characterized by events of great interest, and the proceedings of the last session surpass in extent those of any previous year. The extended importance of the Institution has imposed an augmentation of duty and responsibility on your Council, and they have laboured so to direct the affairs intrusted to them, that the discharge of those increased duties might be attended with a corresponding elevation in the character of the Institution, and that their successors in office may realize a still further progress towards that eminence which is already in some measure attained.

Telford Premiums.—Among the various duties which devolve on your Council, that of disposing and awarding the Telford Premiums is of the

highest consequence, and on the proper discharge of which much of the permanent success of the Institution will depend. The Council, deeply impressed with this, have given their most careful consideration to the subject; they would direct your attention to the following notice of the premiums, and of the respective communications for which they have been awarded.

Mr. Parkes.—In the Annual Report of the last Session, the Council stated that it would be one of the earliest duties of their successors to consider in what manner the benefits conferred by your member Mr. Parkes on practical science, by the communications then alluded to, could be most appropriately acknowledged; and the present Council, concurring most fully in these sentiments, are of opinion, that as no papers have hitherto been received by the Institution, exhibiting so much originality, labour, and ingenuity, in dealing with the facts presented to his notice, combined so essentially with practical utility, they are warranted in conferring on Mr. Parkes the highest honour which the Institution has in its power to bestow. They have awarded, therefore, the Telford Gold Medal to Mr. Parkes, for his communications on "Steam Boilers and Steam Engines," which are now published in the first and second parts of the third volume of the Transactions. These papers, and the discussions to which they gave rise, occupying as they did the attention of several of your meetings, together with the interest which they excited, must be fresh in the recollection of all who were present. It will therefore be unnecessary to dwell particularly on their contents; but, inasmuch as the highest honour of the Institution has been awarded to them, an honour which (it must be remembered) has been but once previously conferred, the Council feel it to be a duty which they owe to the Institution, to themselves, and to the Public, no less than to the author, to point out (as has been partially done in the Report of the last year) some of the principal features in these communications, and the peculiar benefits which are thereby conferred on practical science.

These communications are the continuation of the labours of the author, which commenced with the paper on the "Evaporation of water from Steam Boilers," published in the second volume of the Transactions, and for which a Silver Medal was awarded on a previous occasion. The first communication, forming the subject of the present notice, relates especially to Steam Boilers, respecting which many well-ascertained facts had been collected; but, previously to Mr. Parkes devoting his attention to this subject, no clear and connected view had been given of the various facts or of their relation to each other, and to the circumstances under which they are exhibited. When so represented, it appears that the peculiar circumstances under which Steam Boilers are employed, and their corresponding qualities and characteristics in respect of construction, proportion of parts, and practical management, present certain quantities and relations, which exert a peculiar influence over the results connected with evaporation; and these being clearly developed and understood, indicate correctly the character of the boiler. Certain definite quantities, relations, or exponents, with other facts of paramount importance, such as the effect of the element time, or the period of the detention of the heat about the boiler, and various actions independent of the temperature of the fire, and tending to the destruction of the boiler, are here for the first time pressed on the attention of the practical Engineer. In the second communication, the author traces the distribution and application of Steam in several classes of Steam Engines. In the execution of this task, he is led into a detailed examination of various important questions: the best practical measure of the dynamic efficiency of steam,—the methods employed to determine the power of engines,—the measures of effect,—the expenditure of power,—the proportions of boilers to engines,—the standard measure of duty,—the constituent heat of steam,—the locomotive engine,—the blast, and the resistance occasioned by it,—the momentum of the engine and train, as exhibiting the whole useful effort exerted by the steam,—and the relative expenditure of power for a given effect, by fixed and locomotive non-condensing engines. The bare enumeration of the principal subjects which have been carefully analysed and illustrated by the facts applicable to each respective case, will give some idea of the magnitude of the task here undertaken; and when in addition is considered the elaborate and extensive series of tables exhibiting the results and analysis of the facts collected and used in the course of the inquiry, the Council cannot but feel that a more laborious task has rarely been accomplished. A peculiar feature of these communications, and one to which the Council would particularly advert, is, that they are not of a speculative character, but present a detailed analysis of authenticated facts.

This analysis consists in separating and ascertaining the various results, and in referring them to particular classes, so that they may be readily applicable in practice. The merit of instituting and recording a series of observations upon a scientific subject is universally acknowledged, but the reduction of such observations so as to form a standard of reference to which the practical Engineer may appeal, is a task of far greater difficulty, and its execution of far higher merit. It is in this eminent rank that the Council would place these communications of Mr. Parkes.

Mr. Leslie.—The description by Mr. Leslie of the Harbour and Docks of Dundee, was also briefly adverted to in the last Annual Report, as one of those communications on which the Institution sets great value. It consists of a detailed account of the progress of the improvements projected by Smeaton, Telford, and others, in part carried into execution by the projectors, and completed under the author's own superintendence since 1832. The illustrations of the projected and executed improvements, with the plans, elevations, sections, and details of the works of the Docks, Gates, Quays, Cranes, and Machinery employed, occupy 36 sheets of drawings. To the copious history and description of these works is added an extensive series of observations on the Tides. The determination of these facts for different parts of the globe, is a question of the greatest importance in physical astronomy, and the Council would take this opportunity of pointing out the essential service which may thus be rendered by the Engineer to the cause of science, by his recording the observations which *he* has pre-eminently the oportunity of making. For this valuable record of an executed work, the Council have awarded a Silver Medal and a copy of the Life and Works of Telford.

Mr. Mallet.—A Silver Medal and the Life and Works of Telford have been awarded to your Associate, Robert Mallet, for his communication on the "Corrosion of Cast and Wrought Iron in Water." This communication presents features of no ordinary interest to the Engineer. The comparatively recent introduction of cast iron for the purposes of piling, for wharfs, &c., and of wrought iron in the construction of vessels, has rendered the subject of the action of water upon iron of peculiar importance; the British Association have from time to time granted sums of money for making experiments on this subject, and Mr. Mallet, having been engaged in conducting these experiments, has selected from the very extensive series of results obtained by him, those conclusions which may be of service to the practical Engineer. The most valuable portion of this communication consists of elaborate tables; which exhibit the results of the action of clear and foul sea and fresh water at different temperatures upon cast and wrought iron. Such being the general nature of the experiments, the results to which they lead, or the effects produced, present several remarkable characteristics, and it is found that the corrosive action of water and air combined, produces on the surface of cast or wrought iron a state of rust possessing one of five distinctive features, viz., uniform,—uniform with plumbago,—local,—local-pitted,—tubercular, or some two or more of these in partial combination. The practical results which may be deduced from these tables are of the highest value to the Engineer, and point to considerations of the greatest importance; thus the upper and lower strata of water, of different degrees of saltness and density, coming in contact with the same mass of iron, a voltaic pile of one solid and two fluid elements is formed, and under such circumtances the corrosive action is materially augmented; hence it follows as a practical conclusion, that the lower part of all castings used in such situations, should be of increased dimensions. Similar results, the knowledge of which is of great importance to the practical Engineer, such as the rapid decay of iron in the sewage of large cities, of the bolts of marine engines exposed to the bilge water, and of boilers containing hot sea water, are referred to actions due to similar physical principles. The protection which metals receive from paint, or from the presence of various alloys, so as to obtain a mode of electro-chemical protection, such that, while the metal iron shall be preserved, the protector shall not be acted upon, is also referred to similar principles.

The Council have also awarded a Bronze Medal and Books to Mr. Charles Bourns, for his Communication on "setting out Railway Curves;" to Mr. Chapman, for his description and drawings of "a machine for describing the profile of a Road," and to Mr. Henry Renton, for his description and drawing of "a self-acting Waste-board on the River Ouse."

Mr. Bourns.—The communication by Mr. Bourns is an application of simple geometry, leading to practical results. In setting out curves, recourse has been had to various expedients, but Mr. Bourns, in the propositions contained in this paper, has shown that, by the use of the common chain, an offset staff, and table of offsets, he is enabled to set out curves of any radius and flexure, with a facility and precision not generally attained.

Mr. Chapman.—The description and drawings of a machine for describing the profile of a road, is one of several communications on this subject, sent in accordance with the notice of subjects for competition issued by the Council. Many of the arrangements proposed by the author exhibit considerable ingenuity, and though difficulties may exist in their practical application, the Council think this attempt may be of assistance to others, who may have their attention directed to the construction of an instrument for similar purposes.

Mr. Renton.—The description and drawing of the self-acting Waste-

board on the River Ouse, being an account of an executed work, is one of those communications which the Council are most anxious to encourage by every means in their power. The drawing and description furnished by Mr. Renton are highly creditable to the talents of the author, and deserving of some special mark of approbation.

Mr. Birch.—The Council have also awarded Books to the value of Five Guineas to Eugenius Birch, for his drawing and description of the machine for Sewing Flat Ropes, in use at Huddard's Rope Manufactory. The rope machinery of Captain Huddard was, some time since, one of the subjects on which the Council solicited communications; on that occasion two valuable sets of drawings were communicated, the one by Mr. Dempsey, the other by Mr. Birch. The subject of the present communication was not included in either of the preceding, but Mr. Birch, desirous of availing himself to the fullest extent of the liberality of Mr. Cotton, the then proprietor of the machinery, and of carrying out the views of the Council, has devoted much time and labour to placing in the Institution an exact record of every thing connected with this interesting machinery.

Mr. Maude.—Premiums of Books have also been awarded to Mr. Maude, for his "Account of the Repairs and Alterations made in the construction of the Menai Bridge, rendered necessary by the gale of January 7, 1839," and to

Mr. Burn.—For his drawings of a "Proposed Suspension Bridge over the Haslar Lake." The Council would point out these instances of the fulfilment of the engagements entered into on election, to the attention of the other Graduates of the Institution, who have similar opportunities, but who have not hitherto kept their promises. It is the desire of the Council to obtain an exact record of works that are projected or in progress, and such records are peculiarly adapted to compete for the Telford Premiums: Mr. Maude and Mr. Burn, with proper permission, have availed themselves of the facilities afforded them, and the Council trust that the premiums now awarded, and the marks of approbation here expressed, will stimulate others to avail themselves of like opportunities. The authors of such communications will thus most materially contribute towards promoting the interests of the Institution, and to their own qualification for future employment and advancement in the profession.

Original Communications.—The Institution has received, during the past year, many other communications of acknowledged merit, of which no mention has yet been made. To a few of them the Council would now briefly advert, and especially to the last paper by Mr. Parkes, "On the action of Steam in the Cornish Single Pumping Engine," a communication of no ordinary importance and interest, either on account of its own intrinsic merits, as viewed in connexion with the past proceedings of this Institution, or the future prospects of this department of practical science. This communication, though intimately connected with those of the same author previously alluded to, growing immediately out of them, and depending upon the facts contained in them, is of a totally distinct character; being an attempt to explain, on theoretical principles, the action of the steam on the piston, and to unfold the real causes of the economy of the Cornish engines. This subject has occupied the attention of the Institution during the last four years, and the discussion first assumed a settled form during the Session of 1837, on the receipt of the communication of Mr. George Holworthy Palmer, "On the application of Steam as a moving power, especially with reference to the reported duties of the Cornish and other engines." In that paper the author, reasoning on certain data as to evaporation, and on the physical facts which involved the constancy of the sum of the latent and sensible heat in steam of all elasticities, and of the absorption of heat by matter on dilation, came to the conclusion that no power could be gained by expansive working, and that, consequently, this could not be the *cause* of the economy in Cornish engines. This discussion was revived in the ensuing Session by the communications of Mr. Wicksteed and Mr. Henwood, the former furnishing the first recorded experiment in which the water raised was actually weighed, the latter giving an extended series of most careful and detailed observations on the quantity of steam employed, the mode of its distribution, the duty performed by a given quantity of fuel, and the measurement of the water raised.

Taking for data the facts furnished by Mr. Henwood for the Wheal Towan, and by Mr. West for the Fowey Consols Engines, Mr. Parkes has analyzed the quantity of action obtainable from the quantity of water as steam consumed, and expanded to the extent used in those engines, and has found the steam's force unequal to the resistance overcome. After satisfying himself on various phenomena attendant on the working of these engines, that the amount of resistance opposed to the steam was not overrated, he was led to conclude that from the instantaneous and free communication effected between the cylinder and boiler of these engines, by the sudden opening of the large steam valves, a force must be transmitted to the piston, of a kind distinct from that of the steam's simple elasticity. This force he denominates the steam's *percussive action*; he adduces various proofs that this description of force has operated on the piston, and that it alone was equivalent, in the instance of the Fowey Consols Engine, to drive the piston through $\frac{27}{100}$ths of its stroke.

The author considers the effect produced on the piston of a Cornish Engine, by the sudden impact of highly elastic steam, to be similar to that obtained from water in the hydraulic ram. He has not in his paper entered on the consideration of the absolute amount of percussive force, which can be afforded by an aeriform fluid in motion—but has confined himself to the determination of the quantity of action, which he conceives to have been derived from that source in the particular engines examined. He invites the co-operation of others in instituting experiments on this subject, and the Council hope that the ensuing session will augment the number of facts requisite for the complete demonstration and development of this view of the steam's action.

It is gratifying to reflect how much the present state of our knowledge is due to the discussions which have taken place at the meetings of the Institution. The Council look forward with great interest to the revival of these discussions, and for some valuable communications on this subject which are promised by members who have daily opportunities of making observations and experiments on an extensive scale.

Captain Basil Hall.—Among the other communications, the Council would briefly advert to that by Captain Basil Hall, on obtaining for light-houses all the advantages of a fixed light, by means of refracting lenses in revolution. It occurred to that distinguished officer, that by placing a Fresnel lamp in the centre of an octagonal frame, having a lens inserted in every side, and causing the frame to revolve at a considerable velocity, a fixed or continuous light would be produced almost equal in brilliancy to the intermittent light from the same lamp when the frame revloved slowly.

Many curious effects are observed; thus, when the lenses are first set in motion the effect is a series of brilliant flashes; as the velocity increases, the light becomes more continuous—at about 44 revolutions per minute, absolute continuity is produced—and at 60 revolutions nearly the steadiness of a fixed light is attained. It would appear that the sensibility of the retina is affected by the succession of bright flashes, so that, judging by its intensity when seen through coloured glasses, the light would appear to suffer but little apparent diminution.

Mr. Gordon.—Another subject rather novel in its nature, but of considerable interest to the profession, on the "Application of Photography to the purposes of engineering," was brought before the Institution by your member Mr. Alexander Gordon. The facility with which this discovery may be applied to taking accurate views of buildings, works, or machinery at rest, renders it an object of great interest to Engineers; since by these means may be obtained the general dimensions of works, with perfect accuracy, in a very small space of time, and by affixing a graduated scale to the objects to be copied, the photographic delineation would present the means of determining the dimensions of every part.

Mr. Cooper.—The Council cannot omit this opportunity of acknowledging the obligations which the Institution is under to Mr. Cooper, and Mr. Cooper, jun., who illustrated the preceding communication, by exhibiting and explaining the apparatus requisite for the production of the delineations of photography.

Obituary.—The Institution has to regret the loss by death, of Mr. Francis Bramah, Mr. Oldham, Mr. Rowles, and Mr. Rickman; individuals distinguished for their attainments in professional and general knowledge, and endeared to the Institution by long association and deep attachment to its interests.

Mr. Bramah.—Francis Bramah was the second son of the late Mr. Joseph Bramah, whose numerous inventions, perfection of workmanship, and genius in the mechanical arts, have rendered his name so widely and justly celebrated. The opportunities afforded to the son were ardently embraced by a mind of no ordinary powers, deeply imbued with the love of knowledge. Although his attention was in early youth more particularly directed to branches of minute mechanical construction, his acquaintance with the principal departments of professional knowledge and general science was very extensive. His attachment to the arts and to science was deep and sincere, and among many proofs of this may be particularly mentioned the valuable and essential services which he rendered to your late Honorary Member, Thomas Tredgold, both in his professional pursuits, and in the prosecution and verification of his theories and calculations. Mr. Bramah being professionally engaged at Buckingham Palace, in connection with some other engineers, difference in opinion existed and discussion arose, as to the true principle upon which the strength of cast-iron beams to resist stress and flexure ought to be estimated, and with the view of verifying the principles laid down by Tredgold, he instituted a very extended series of experiments on the deflection and

strength of cast-iron beams. These he presented to the Institution, and they are published in the second volume of your Transactions.

Several important works were executed under his direction, among which the iron-work of the Waterloo Gallery at Windsor Castle; the cranes, the lock-gates, and their requisite machinery, at the St. Katherine's Docks; and the massive gates at Constitution Hill and Buckingham Palace, may be particularly mentioned. Mr. Bramah was an early and deeply-attached Member of this Institution; his constant attendance at the meetings, the information which he communicated, and his unwearied zeal as a Member of the Council, cannot be too highly estimated, and his loss will be deeply felt and regretted within these walls. The variety of his attainments, his refined taste in the arts, his amiable character and the warmth of his affections, had secured to him the respect and esteem of a most extensive circle of friends, by whom, as indeed by all in any way connected with him, his loss will be most deeply and sincerely felt.

Mr. Oldham.—John Oldham, the Engineer of the Banks of England and Ireland, was born in Dublin, where he served an apprenticeship to the business of an engraver, which he practised for some time, but subsequently quitted to become a miniature painter, wherein he acquired some reputation. He pursued this branch of the arts for many years, but having a strong bias towards mechanical pursuits, he devoted much of his leisure time to the acquisition of that knowledge which was to prove the foundation of his future celebrity. In the year 1812, he proposed to the Bank of Ireland his system of mechanical numbering and dating the notes, and on this being accepted, he became the Chief Engraver and Engineer to that Establishment. The period of twenty-two years, during which he held this appointment, was marked by continually progressive steps of artistical and mechanical ingenuity. The various arrangements which he projected and carried out attracted great attention, and conferred considerable celebrity on the establishment with which he was connected.

The late Governor of the Bank of England, Mr. T. A. Curtis, had his attention directed to these important improvements, and under his influence the whole system of engraving and printing as pursued in the Bank of Ireland was introduced into the national establishment of this country, under the superintendence of its author, who continued in the service of the Bank until his death.

The ingenuity of Mr. Oldham was directed to other objects, especially to a system of ventilation, of which an account was given by the author during the session of 1837. Great versatility of inventive faculty, persevering industry, and social qualities of the highest order, were the prominent features in his character, and the success which attended his exertions is one of the many gratifying instances to be found in the history of this country, of talents and industry destitute of patronage attaining to eminence in the professions to which they are devoted.

Mr. Rowles.—Henry Rowles, the chairman of the Rymney Iron Works, was educated in the office of his relative, Mr. H. Holland, the architect, on quitting which he entered into business as a builder. He was engaged among other extensive undertakings in building several of the East India Company's Warehouses, the Royal Mint, the Excise Office, and Drury Lane Theatre. He was an active Director in several Docks, Railway, and other Companies, and finally became Managing Director of the Rymney Iron Works, in the active discharge of the duties of which office he continued until his death. The Institution owes to him the drawings of the Iron Works made by Mr. Richards.

Mr. Rickman.—John Rickman was educated at Lincoln College, Oxford, and graduated there; he subsequently devoted himself to literary pursuits, to political economy, and to practical mechanics. For some years he was conductor and principal contributor to the "Agricultural and Commercial Magazine." In 1801 he removed to Dublin, as Private Secretary to the Right Hon. Charles Abbot, then Keeper of his Majesty's Privy Seal in Ireland. Upon the election of Mr. Abbot to the Speaker's Chair in the House of Commons, Mr. Rickman continued to be his Private Secretary, and in 1814, he was appointed to the table of the House of Commons. He also acted as secretary to the two Commissioners appointed by Act of Parliament in 1803, "for the making of Roads and Bridges in Scotland, and for the construction of the Caledonian Canal," and to the Commissioners "for building Churches in the Highlands." The ability and energy which he displayed in the discharge and conduct of the duties of these laborious offices, for more than thirty years, in addition to his constant attendance at the House of Commons, called forth the warmest acknowledgments of public meetings held in the Scotch counties on his retirement, and various resolutions were passed expressive of the sense entertained of the unremitting exertions, and uniform and disinterested assiduity, with which he had promoted every object connected with the improvement and general prosperity of the Highlands and Isles of Scotland. The conduct of the affairs of the Highland Commissioners brought Mr. Rickman into constant intercourse with their engineer, Mr. Telford; an intimate friendship was formed between them; and Mr. Rickman completed and published the account of the Life and Works of that eminent man, which was but partially arranged at the time of his decease.

Mr. Rickman's chief work is the Census of Great Britain, in six folio volumes; he is also the author of numerous papers connected with Statistics, having bestowed great pains in collecting and arranging the returns connected with education and local taxation. To this Institution he rendered very essential services, and whenever application was made to him in its behalf, was always zealous in endeavouring to promote its interests. The Library was enriched by him with two copies of the Life and Works of Telford, and as the acting executor of Telford he endeavoured to carry out by every means in his power the intentions of that great benefactor of the Institution.

Mr. Rickman's acquirements in every department of knowledge were accurate and extensive; to great quickness of perception, and memory of no ordinary power, were added indefatigable industry, undeviating method, and a sound critical judgment;—qualities which caused his acquaintance to be highly valued by the most distinguished literary characters of the day, and which, no less than the strict and scrupulous sense of justice and honour, which particularly showed itself in his considerate kindness towards all those with whom he was connected, will occasion his loss to be deeply regretted by a widely extended circle.

SCIENTIFIC SOCIETY OF LONDON.

THIS society held its fifth conversazione of the present session on Thursday, March 18th, when Charles Moxon, Esq., Honorary Curator, presided. This meeting was very numerously attended, and evinced much gratification at the amusements of the evening, consisting of the exhibition of a number of specimens of Daguerrotype, by Messrs. Claudet and Houghton, and in addition, the newly arranged geological and botanical departments of the Museum were open to the inspection of the members and visitors. Mr. Woolley delivered a very interesting lecture on "Fresco painting," in which he dwelt upon the manner in which it is executed, and the state in which the colours of antique frescoes were found; he also noticed the works of the great masters of the art, and its revival in modern architectural embellishments, especially in Germany. The company did not separate till a late hour, and appeared much gratified with the evening's entertainment.

TO THE EDITOR.

SIR,

As your valuable journal is one which is looked to by the public for information connected with the profession of land surveying, I must beg to direct attention to the dilatory proceedings at the Poor Law and Tithe Commission offices, in the examination of the parish maps, which are there submitted for the approval of the Commissioners.

The subjecting of surveyors to the control of an arbitrary power, one would think is sufficiently discouraging to professional men,—but when that control is coupled with a delay, which is unaccompanied by a compensating result for the public good, the evil presents itself in a more unpleasant form. Such is the consequence of the practice I have to describe.

By the terms of the contract which the surveyor is obliged to subscribe, in undertaking a parish survey for the purposes I have named, he is required to send the map and field-books to the Commissioners for their examination; and experience records, that the surveyor may consider himself very fortunate if he gets his

map through the ordeal within six months. That comparative celerity is to expected when the surveyor is in *direct* communication with the Tithe Commissioners. There are cases, when the maps are for the purposes of the Poor Law Act, where the surveyor contracts with the land valuer, who has contracted with the guardians, to perform the entire of the work. Many retarding causes arise out of this arrangement, and a few of them are as follows: after the completion of the field work, the surveyor sends the map and the field books to the Poor Law Commission Office; they remain there until the time arrives for their departure, and they are then forwarded to the Tithe Office. After the map and books have undergone an examination by the Tithe Commissioners, an explanation is required from the surveyor of some portion of the mapping. The map and field books are then "in due course" returned to the Poor Law Office, and they remain there until another "due course" arrives, when they are packed off "per coach" to the union where the parish belongs, and to which the map has pretensions to a "settlement." The map and books are afterwards forwarded to the valuer, and from the valuer they are sent to the surveyor. Perchance the surveyor may reside within a few hundred yards of the Tithe Office, and the distance of the Union be sixty or seventy miles, in many cases greater; and yet, strange to say, the orbit of circumlocution which I have described must be travelled by the map, before it arrives at maturity for the surveyor.

This is repeated as often as the Commissioners require an explanation from the Surveyor.

The effect of such a practice is by no means trifling; it is a delay to the public, and an expense and an injury to the surveyor.

The importance of the subject will be fully understood by those surveyors who have embarked their capital and labour in parish surveys; and I trust that the allusion to it will be the means of stimulating them to give publicity to other grievances, which attend the practice of land surveying under the Tithe and Poor Law Acts.

I am, Sir,

Your Obedient Servant,

March 16, 1841. A Land Surveyor.

REACTION OF RAILWAY JOBBING.

TO THE EDITOR.

Sir,

Railways, like children, are in themselves very useful and valuable; but when they are not legitimate they are a disgrace to the parties, and apt to become burdensome to the parish.

To convince ourselves of the truth of this, we have only to look at the vast sums that have been paid as Parliamentary and other expenses, which contributed not a jot to the construction of the works. But this, though great, is but a drop in the bucket as compared with what has been pocketed by others, without ever seeing the light of day. This, however, is not the principal subject to which I wish to address myself in this short epistle. I rather wish to draw attention to the locality of the mania, and the class of persons among whom it has raged with the greatest inveteracy, and under the most rabid type.

Upon most occasions London has been the field for jobbing, and the Stock Exchange the centre whence jobbing manias emanated. There it was chiefly confined to speculators in the funds, and it was only occasionally that the mania made an inbreak on the commercial world. When it did, it was like the eruption of a volcano, or an inundation of a river or the sea; for it swept to destruction all that came in its way.

That there were Stock Exchange jobbers concerned in the originating of some of the railways, I do not mean to deny, for Stock Exchange men have a proneness to dabble in every kind of gambling; but the Stock Exchange, or money market as it is termed, is not what it was once. The comparative tranquillity of foreign countries, and the little demand there now is for foreign loans, have reduced it to the mere shadow of its former self; and, in the case of railway shares, there was not that immediate handling of a bonus which used to tempt the great money speculators to contract for a loan.

The natural consequence was, that the railway speculations operated chiefly upon those who sought to get jobs of a different kind, in quite a different way. These were the lawyers, or rather those pretending to be lawyers, who hang about the Houses of Parliament, especially the Commons' House, in search of the rich garbage which is obtainable there, not always in the manner which men unaccustomed to that kind of work would think honourable, still, —whether upon the principle of "stolen waters" I pretend not to say—as being sweeter to the parties than if earned in a way which every man would justify and applaud. I shall one day take an opportunity of dissecting and demonstrating one of these "Parliamentary Agents" as they are called; and so in the meantime I shall merely remark that they are a breed altogether *sui generis*, and quite different from even the fag end of the pettifoggers of the common law.

I do not say that these persons could have ever brought their projects before Parliament without the co-operation of Engineers; but we must allow these a *locus penitentiæ*, a "stool of repentance," or "cutty stool," as it is termed in Scotland, in the case of certain engineering delinquencies. The said engineers got the offer of jobs, with a promise of abundant fees, and the next thing to an absolute certainty that those fees would be paid. Under such circumstances it would have ill become the engineers to scrutinize too minutely into the characters of the jobs. With the surveyors the case was of a still more simple nature; for these were employed by the engineers, and consequently they were two removes from the projectors,—and thus they could be said to have had no hand in the projects.

Indeed, in so far as the surveying was not done by the apprentices of the engineers, it tended greatly to lessen the character and importance of that class of professional men; and, though some pains was taken to conceal them, there were not wanting instances in which the companies had to pay thousands from attempting to save hundreds by bad surveying; and they got wretched lines after all, and not one word of information as to the nature of the strata. Many of our engineers, of the highest name, were employed on these railways; and it is really astonishing, and would not be credited in any other country, that they had so litttle conception of the value of surveying, or, at all events, that they cared so little about it. Nine tenths of the projects for this species of intercourse, demonstrate more clearly than words could do it, that the projecting parties cared nothing about the utility of the lines, or indeed whether they were at all executed, or executable. All that they cared for appears to have been, to obtain Parliamentary authority for doing as little as ever they could, and getting as much for it.

The parties among whom this expense, which contributed not a stiver to the execution of the work, has all along been shared,—are

three. First, The Parliamentary agents, and those who beat up for the amount of capital, real or imaginary, which is required before parties can go to Parliament. Secondly, Engineering, including of course Surveying, and all other matters requisite for the approbation of Parliament, or for mystifying that august assembly, so that they could not understand what was meant. Notwithstanding the constitutional wisdom of those who have seats in the Commons' House, and that this wisdom is weighed in the balance of county and burghal constituencies, it should seem that the old Adam cleaves as pertinaciously to them as to any other class of persons. One of the modes in which the said Adam displays itself, is taking for truth all speeches and writings which he does not understand; and in the assembly alluded to, this may be considered as the rule, and not the exception. The reason is obvious: if a question is of a somewhat complicated nature, and parliamentary agents endeavour to make whatever they bring before the House as complicated as possible, the unravelling of it, as a matter of truth, would require more brains than the honourable gentlemen have time to bestow, or than God has given them. Hence, the short and easy way is believing; and if mankind are to be saved by faith alone, getting a seat in parliament is tantamount to getting a seat in the kingdom of heaven, for there is more faith, without any admixture of the leaven of common sense, among those parties, than among any equal number of other men that could be named.

Secondly, there is the expense of engineering; and though the amount of this should be, and generally is, published, no data are afforded by which the ratio of the work done, and the price paid for it, can be estimated. In every case, however, I am safe in concluding, that, *quâ* engineer, the sum paid is never too little.

In the case of a railway of moderate extent, and a single bill, or one application to parliament, the sum of the two items which I have mentioned may average from £30,000 to £50,000; and though the engineering is generally less than the parliamentary expenses, it is not so much less as one would be led to suppose.

There is however a third item, which is never brought into the published statements; and therefore it is quite unknown, except to the directors; or rather perhaps to that clique of directors by whom the rest of the board, and also the subscribers, are led like pigs by means of rings in their noses. From what has been said, any one may see that there is no getting at this third item of expense: but I do not overrate it when I say that it is equal to the other two taken together. Thus we may fairly conclude, that from a fifth to an eighth of the whole cost of a railway goes, upon an average, into the pockets of the parties concerned; and those who have the conducting of the bill through Parliament, are sometimes the same parties who have the direction at the onset, and until the speculation can no longer be made an instrument for fleecing the public.

And this is the sort of gaming-table which the merchants of Manchester and Liverpool have frequented more than any others; and one may naturally suppose that the stakes which they have hazarded have been in proportion to their fondness for the game, and the extent to which they have entered into it.

Now, any one who pays due attention to the subject, will perceive, and be ready to admit, that the playing of such a game is sufficient occupation for any man, be his business talents what they may. On the other hand, the merchants of Manchester and Liverpool have the management of a very large and highly important part of the trade of Great Britain—of that commerce which has elevated her to her present high place in the scale of nations. Here we have two subjects of comparison: on the one hand, we have the merchants and manufacturers of the first manufacturing town in England, and the merchants and shipowners of the second port, engaged in a gambling speculation about railway shares, which speculation, if they attend to it properly, is quite enough for the engrossing of their whole time and attention. On the other hand, we have the very same parties engaged in manufactures, and in domestic and foreign trades, which are also quite enough to engross the whole of their attention; and I need not say whether the gambling or the carrying on of the legitimate trade is the occupation more becoming the parties, and more useful to their country.

It is not in the nature of things that they can do both, and do them well; and the fascinations of gambling are such, that a person who once gets fairly and fondly devoted to it, knows not where to stop, but will sacrifice business, fortune, friends, and even life itself, in the service of this insinuating idol. The probability therefore is, that these merchants will cling to their railway mania to the utter neglect of their proper occupations. These will in consequence get into confusion, and the trade of the country will be hurt beyond all surgery, in a place where it can least be borne. Without any gambling in railway shares, or indeed in any thing else, the trade of those towns is always a little precarious. Much of it is with America; and every one knows that the commercial state of that country is unsound and rotten, and the moral character of its inhabitants not much better. Such being the fact, and nobody can deny that it is so who knows anything about the matter, one would actually conclude that the people of Manchester and Liverpool have quite enough to do at home; and if they continue to disturb and paralyse this by extraneous matters, they will in the end find out the truth to their cost. No crash has yet come; but there is a boding sound on the wind, like that which moans through the tranquil air for a short time before the hurricane rends an American forest to shreds.

I have heard certain unpleasant rumours mooted upon this subject; but as they are not ripe for action, and as they involve the fortune and character of individuals, it will be unfair to mention them. If, however, the merchants of these towns will persevere in their present course, the gambling will not fail to draw them by degrees from their legitimate business, and to hold them so fast, that ruin will be inevitable. The failure of a great house in any trade is a serious matter; but were anything to paralyse the factories of Manchester and the commerce of Liverpool, it would be one of the blackest days that England ever saw. I do not say that the people of these towns ought to be coerced into the mode in which they are to use their capital; because I believe the very worst applications of money are those which are according to statute. But I do think that parties who are of such vital importance to the welfare of the country ought to be remonstrated with, more especially if they are bitten by a gambling mania, as seems at present to be the case in the towns alluded to. It is true that nothing serious has as yet actually taken place; but in the case of rabid diseases, the result is always the more direful, the longer that the poison remains in the system without displaying any symptom. Therefore, the people who are so severely bitten by the mania, must not allow themselves to suppose that all is safe because the crisis is delayed; for the delay enables the virus to sink deeper, and incorporate itself with the system; and therefore when the symptoms do break out, there is no cure.

CRATES.

REVIEW.

Practical Rules for the Management of a Locomotive Engine, in the Station, on the Road, and in cases of Accident. By C. H. Gregory, C. E.—Weale, 1841.

Of all the accidents that have happened to railway trains,—and the noise that has been made about them, has been out of all proportion to their number—by far the greater part have been occasioned by those having the conducting of the trains, and they, too, have been the chief sufferers. This latter circumstance precludes the possibility of supposing that either engine-man or stoker could be guilty of wilful neglect, because no man would do that of which the sacrifice of his own life would be the inevitable consequence. These accidents must, therefore, be the result of ignorance; and though there have been glaring instances of total incapacity on the part of engine-men, charity to the directors forces us to conclude that these form the exception, not the rule.

But why should it happen in any case, that men, who must be professionally aware of the danger, bring its fatal consequences upon themselves by their own neglect? The main cause seems to be this—a locomotive engine is a very complex machine, consisting of a vast number of parts, and all these parts require to be constantly in the best possible working order. But few men have such memory as to have constantly in ready and equal remembrance so many subjects; and thus the engine-man requires to have a pocket vade-mecum of all that he has to do, expressed in the shortest and simplest terms.

This is what Mr. Gregory's book professes to supply; and we must say that it is supplied fully, completely, and well. The book is so small, that it may be carried in the waistcoat pocket; and yet it points out, clearly and fully, all that the engine-man has to do, in preparing for his trip, in conducting his engine on the line, and in case of accidents. Every railway company ought, therefore, to make it a *sine qud non*, that each engine-man in their employment should have the book constantly in his pocket, and consult it, and follow its directions, upon all occasions. This would do more for the prevention of accidents than all the projects, about which pseudo-inventors have puzzled their heads to so very little purpose. The book is so brief, that it hardly admits of analysis; but we shall extract two passages:—

THE MANAGEMENT OF A LOCOMOTIVE ENGINE IN CASES OF ACCIDENT.

An engine is liable to several accidents while running, and it is important that the engine-man should know how to act promptly under the circumstances. In the following list several cases are enumerated, with the particular steps to be taken in each.

1. *The bursting of a tube.*—The engine-man should stop the engine, and drive a plug into each end of the tube. It frequently happens that the water and steam blow out with so much force, that it is impossible even to discover the defective tube: by running the engine for a short distance with both pumps acting, the pressure of the steam will perhaps be sufficiently reduced to enable the engine-man to work with safety; but if the escape of water and steam is still too great to do so, he must run his engine and train, if possible, off the main line into a siding, and draw the fire, to prevent its injuring the fire-box and tubes: when the water has run out down to the level of the defective tube, it may be easily plugged, and a fresh fire laid and lighted. A tube will frequently leak to a considerable extent without absolutely requiring the stoppage of the train; but in this case, great care is necessary not to use much steam, or urge the fire too far.

The bursting of a tube or other causes, will sometimes lead to the lagging or casing of the boiler catching fire, which should be extinguished by throwing on water from the tender-cistern in a fire-bucket, or from the water crane at a station.

2. *The failing of one of the feed-pumps.*—In this case, the adequate supply of water may, with care, be maintained by one pump only. The supply of coke must be regular, and not in large quantities; and the steam must be economised, or the water may run low. The pump should be repaired as soon as possible; this may frequently be done in the interval between two trips.

3. *The breaking of a spring.*—This is an accident which does not necessarily involve the stoppage of the train; but as working the engine in such a state causes an unequal strain, it should run very gently over rough parts of the road; and if the derangement is considerable, and cannot be repaired at the stations, the engine should cease running as soon as possible.

4. *The breaking of a connecting-rod, or its disconnection* by the loss of cotters, fracture of the straps, &c.—This accident, or any disconnection which allows the piston to be driven from end to end of the cylinder without restraint, causes expensive damage to the cylinders and covers; and the connecting-rod, if loose, will seriously injure the smaller gear, or may even throw the engine off the road. The engine should therefore be instantly stopped, and, if possible, the connection restored; if that cannot be done, the connecting-rod must be taken off, and if on a level or a descending gradient, the train may sometimes be drawn by a single cylinder: to do so, the slide-valve spindle of the defective cylinder must be detached from the valve gear, by unscrewing the nuts, and setting the slide at the middle of its stroke so as to cover both ports.

If it should be found impracticable to move the train, the engine might run on alone for assistance; but in any case where the engine is obliged to remain stationary, the fire must be drawn directly the water is down to the bottom cock.

5. *The fracture or disconnection of the eccentrics, or any of the slide-valve gear.*—In engines without hand-gear, if the connection cannot be restored, the attempt may be made, as in the previous instance, to work with one cylinder. When the slide-valve gear is disabled, engines with hand-gear possess an advantage which others want, in being able to be worked by hand, when a single cylinder would be unequal to the duty, from not being able to move the crank over the centres at starting.

6. *The fracture of the strap which holds the slide-valve,* renders unavailable the cylinder on that side where it occurs, without affecting the other side. The slide should be detached, and placed in the middle of its stroke, and the attempt made to work with one cylinder.

7. *The disconnection of a piston,* by the fracture of either cotter, is sometimes caused by shutting off the steam too suddenly, when the engine is travelling fast with a heavy load. In this case, also, the slide should be detached and set in the middle position, and the piston-rod uncoupled from the connecting-rod, which should be removed to prevent its damaging the small gear.

8. *The breaking of an axle,* in a four-wheeled engine is an accident which is almost of necessity attended with the overturn of the engine. In a six-wheeled engine it requires the stoppage of the train until assistance arrives.

9. *The Engine running off the rails.*—With an engine-man who drives carefully, watching well the position of the switches, and the signals given him, and stopping when he sees any danger attending his further course, this is an accident of very rare occurrence. If the engine should run off on hard ground, and near the rails, it may sometimes be lifted on again at once by screw-jacks, crow-bars, and long sways; but if on soft ground, or far from the rails, the fire must be drawn, and instant attention given to prevent its sinking deep into the ground.

The engine should first be separated from the tender, which, being a lighter weight, may be pushed out of the way, and leave more room for operating on the engine; this, if it has fallen over on its side, should be lifted as quickly as may be into a vertical position; to do so, a purchase should be obtained under the framing on the lowest side, in two places if possible; two long and tough sways should be brought to bear on these points, and several men placed to weigh upon each; and as the engine is gradually lifted by the sways, every movement should be followed up and supported by screw-jacks bedded on timber blocking. When the engine has been lifted upright, it should be firmly supported by timbers placed as stanchions under the framing; the earth may then be cautiously removed from under the wheels, and a length of rail introduced, taking care to bed it as securely as possible on the blockings previously laid down, without disturbing them: the same process should be repeated on the other side, and cross sleepers driven in under both rails to secure the foundation. As soon as the engine is in a vertical position, and rails inserted under the wheels, a temporary railway may be laid down in continuation, and the engine again drawn on the main line. It will much facilitate the raising of the engine if the water is drawn away out of the boiler as soon as it is sufficiently cool.

REGULATIONS FOR THE FIRST APPOINTMENT OF AN ENGINE-MAN, ADOPTED BY THE DIRECTORS OF THE LONDON AND CROYDON RAILWAY.

1. The candidate must not be under twenty-one years of age, and must produce a certificate of a sound constitution and steady habits.

2. He must be able to read and write, and, if possible, understand the rudimental principles of mechanics.

3. It will be a great recommendation if he has served his time to any mechanical art, especially as a fitter of locomotive engines; and, if possible, he should produce testimonials stating his qualifications as such.

4. If the candidate has been a fitter, or a stationary engine-man, he must, for several months at least, have been a stoker on a locomotive engine, under the direction of a steady and competent engine-man; and before his appointment, he should produce a testimonial from the superintendent of locomotives, or at least from the engine-man under whom he has served, stating full confidence in his acquaintance with the construction of an engine, and the principles of its management.

5. If the candidate has not been a fitter, or a stationary engine-man, he must have served as a stoker for at least two years, and produce the testimonials named in the preceding rules.

6. If required by the Board of Directors, for greater security, the candidate must undergo an examination from their engineer, superintendent of locomotives, or other competent person, as to his knowledge of an engine, and its management, and the general result of this examination must be committed to paper, signed by the examiner, and presented to the Board.

7. The engineer or superintendent of locomotives of the railway to which the candidate is desirous of being appointed, shall sign a certificate stating that he has conversed with him, has seen him drive, and has confidence in his steadiness and ability.

8. Before being allowed to take the entire charge of an engine and train, the candidate must drive for several days under the direction of an experienced engine-man, who must be on his engine, and certify to his ability.

9. All certificates and testimonials must be deposited with the secretary of the company, who will restore them to the owner on his leaving their service.

AN ACCOUNT

OF THE REPAIRS AND ALTERATIONS MADE IN THE STRUCTURE OF THE MENAI BRIDGE, IN CONSEQUENCE OF THE DAMAGE IT RECEIVED DURING THE GALE OF JANUARY 7, 1839. BY T. J. MAUDE, GRAD. INST. C. E.

The roadway of the Menai Bridge having been seriously injured by the storm of January 7, 1839, it was deemed expedient to renew entirely the suspended platform: and at the same time to carry into effect certain alterations in the construction, suggested by constant observation of the working of the Bridge during thirteen years, as well as its condition after the storm.

In the original structure, each long roadway bar was fixed at three points to the vertical suspending rods. Motion being chiefly communicated to the roadway by the vibration of the windward chain, one end of the long bar suspended from it was lifted up, whilst the other two points of suspension remained nearly stationary. The bar thus became a lever with its fulcrum at the middle point of attachment, and at that weakest part it invariably broke. In order to remedy this defect, an augmented depth of half an inch has been given to the new roadway bars, with an additional enlargement round the eyes for attachment to the suspension rods, and each bar is hung from two points only, permitting it to play when the Bridge is subjected to motion.

The same vibratory action occasioned frequent fracture of the suspending rods close to the surface of the platform; to such an extent, that during the storm a great portion of the platform was entirely torn from its fastenings on one side, and hung down flapping in the gale supported merely by one line of rods. To remedy this, a joint has been introduced in each rod just above the surface of the platform, so as to allow the suspension rods free action, and permit a motion in either of the carriage-ways or the footpath independently of each other. The dimensions of the short suspension rods have been increased to one inch and a quarter square, whilst the remainder of the rods are only one inch square. The effects of the lateral and undulating motions are provided against by the direction of the working of the joints, one of them being in the line of the roadway bar, and the other at right angles to it.

Additional rigidity has been given to the platform by applying a course of three-inch planking laid transversly throughout its entire length, and bolted through each plank at intervals of two feet six inches apart, the oak beams originally placed beneath the platform having been entirely removed.

For the purpose of checking longitudinal undulation, two lines of beams, formed of two pieces of Baltic fir, each 40 feet long, 13 inches deep, and 4½ inches thick, are framed to the trussed bearers, and bolted up beneath each carriage-way the entire length of the platform: at the same time an increased depth has been given to the wheel guides, which are also bolted through to the planking. The total depth given by these strengthening beams and guides, is three feet four inches, while in the original structure it was one foot four inches.

The weight of the additional timber and iron-work introduced into the bridge, is about 130 tons. The whole of the timber has been Kyanized, and each coat of planking covered with Archangel tar; the felt has been discarded, as it does not appear to have answered its intended objects in the original structure.

In these alterations (which were designed by Mr. Provis, M. Inst. C.E.) one main object, which was never lost sight of, was to preserve that simplicity of construction which is so striking a feature in the original design; and should any future derangements occur, any part can be repaired or replaced without disturbing the rest of the structure.

NOTES ON RAILWAY STATISTICS.

BY HYDE CLARKE, ESQ., C.E. F.L.S.

At the present moment, when the railway interests, and all the separate interests connected, are in imminent danger from legislative interference, the elucidation of the true position of the railway system, as one of the great interests of the country, is of some importance. The materials which we have for this purpose are extremely deficient, but still they are quite sufficient to ensure us against any error, as regards the main circumstance, the general relation which the amount of capital invested in railways bears to that invested in other branches of national enterprise. Although there are no established data beyond the calculation of the amount of capital invested in the cotton manufacture, yet, as this is the greatest manufacture, employing two millions of our population, we are secured as to other manufactures by having a maximum, beyond which we cannot go. Taking such materials as can be obtained from Macculloch and Mr. Whishaw, we shall still have enough to lead to important results. The capital embarked to railways we shall for this purpose take at sixty millions, a sum rather under the mark than over, and which will not include floating capital (about £2,000,000), capital employed in making locomotives, carriages, &c. Most of the amounts hereafter given, which are all much above the mark, include both floating and fixed capital, and capital of every kind.

	£
Railways	60,000,000
Bank of England and other joint stock banks	50,000,000
Shipping	40,000,000
Cotton manufacture	34,000,000
Woollen manufacture	25,000,000
Canals	20,000,000
Silk	15,000,000
Linen	15,000,000
Hardware	15,000,000
Leather	15,000,000
Mines	10,000,000
Iron works	10,000,000
Steam navigation	6,000,000
Earthenware	3,000,000
Fisheries	3,000,000

Ship-building, glass, &c., all inferior amounts.

It thus appears that the capital invested in railways far exceeds that in any other department of the national industry (excluding agriculture), and it has, therefore, an imperative claim upon the legislature for consideration.

The number of miles of canal is about 2,400, the number of miles of railway is about 1,750, of which about 400 miles are single, and the rest double. About 1,300 miles are on the 4ft. 8½ gauge. The number of miles at work is about twelve or thirteen hundred. The weight of iron consumed is:—

	Tons.
Rails	200,000
Chairs, &c	40,000
Locomotives, &c	12,000
Total	252,000

The cost of this would be above £3,000,000, an amount calculated, as it has done, greatly to benefit the iron trade; all the rails for the American lines, about 250,000 tons, and 50,000 tons for foreign lines, have been supplied, so that a boon of about seven millions has been conferred on the iron masters by the railway system—of this sum, about two millions are supposed to be profit. The quantity of pig-iron required to make these seven hundred thousand tons of rails &c., would, on account of the loss in puddling and rolling, be about a million of tons. The number of locomotive engines employed is about 400, requiring the attendance of as many drivers and firemen, having a large capital engaged in their manufacture, and about a thousand men employed for their repair. The cost of repairing is about £100,000 per annum. The value of the coke and coal consumed is about £200,000 per annum. Annual value of clothing for servants, policemen, &c., £20,000. Men employed, about 9,500, viz.—

Engine-drivers and firemen	900
Engine-men &c., engaged in repairs	1,600
Guards and porters	2,000
Policemen	1,200
Coke makers	300
Storekeepers, &c.	250
Secretaries, superintendents, clerks, &c	450
Resident engineers, &c	50
Labourers, messengers, &c.	250
Waymen	2,500

The sum expended in coaches, waggons, trucks, &c., has been about a million, and the cost of their annual repair £150,000; the men employed in their repair, about 600.

The amount paid to the landed interest for land and compensation has been nearer to eight millions than to any other sum, one-half of which at least must be a pure bonus. The landed interest, besides, has derived advantage from diminished poor-rates, and increased facilities of communication.

The sum expended on Acts of Parliament may be probably calculated at three quarters of a million, the cost of the Newcastle and Carlisle Railway, 61 miles long.

The five millions spent in compensation, Acts of Parliament, law-suits, &c., would have furnished the amount demanded for Irish railways. The average loss to which Railway Proprietors have been subjected by the legislature has been above eight per cent., so that if railway shares are not at that discount generally, no thanks are due to the legislature. If we were to take the average loss at 8 per cent, and apply it to the cases of different Companies, the result would be thus, taking the per-centage on the gross cost, and then giving it in proportion to the capital:—

Birmingham	14 per cent
Great Western	13
South Western	15
Birmingham and Derby	15
Birmingham and Gloster	11
Blackwall	11
Manchester and Leeds	10
Midland Counties	12
North Midland	11
York and North Midland	12

It will thus be seen, that in the few cases taken here indiscriminately, the amount taken out of the pockets of the shareholders is not less than 10 per cent., and often 15, which, upon a dividend of 5 per cent., makes from one-half to three-quarters per cent. difference. How many lines have been checked in their progress for want of this 10 or 15 per cent., and how many shares with small dividends might be made saleable were it not for such disgraceful legislation? It need scarcely be said that the public are the sufferers in the end, by having this extra per-centage put upon them.—*Railway Magazine.*

NOTICES OF INTENDED APPLICATIONS TO PARLIAMENT FOR RAILWAY BILLS.

Brecon and Merthyr Tydvil Railway.—Commencing near the Brecknock and Abergavenny Canal, Brecon, and terminating at Merthyr Tydvil, also for power to make an extension from thence to the head of the Taaf Vale Railway, near the Plymouth Iron Company's Pier, on the eastern side of the river Taaf.

Bury St. Edmund's Railway.—Commencing by a junction with the Eastern Counties Railway, in the parish of Kelvedon, and terminating at Bury St. Edmunds, to incorporate a Company, or to authorise the Eastern Counties Railway Company to do so, and to alter, amend, enlarge, and extend powers and provisions of the said Company's Acts.

Central Kentish Railway.—Commencing in the parish of Deptford, and terminating near the town of Deal, and also to make a deviation line commencing from the said line in the parish of St. Mary Cray, and terminating by a re-union with the said main line near Maidstone; also to make a branch at Westwell, terminating by a junction with the South Eastern Railway, near Crow Corner, Willesborough.

Doncaster Railway.—Commencing by a junction with the North Midland Railway, at or near the Swinton station, and terminating near the end of Factory-lane, Doncaster.

East Anglian Railway.—Commencing at the proposed terminus of the Northern and Eastern Railway, at Hockerill, Bishop's Stortford, communicating with Cambridge by a branch, passing close to Norwich, and terminating either at Easthill, or near the Suspension-bridge, Great Yarmouth, with a branch deviating from the main line.

Evesham and Eckington Railway.—Commencing by a junction with the Birmingham and Gloucester Railway, at Eckington, and terminating in the parish of St. Peter, Bengeworth, Evesham, with a branch from Charlton to Mastow-green.

Falmouth Branch Railway.—Commencing near the King's Arms Inn, Falmouth, and terminating on the line of the Bristol and Exeter Railway, near Cowley Bridge, Devonshire.

Great Northern Railway.—Commencing in the parish of Clerkenwell, passing close to Cambridge, Lincoln, Gainsborough, and terminating in Nether Poppleton by a junction with the Great North of England Railway; with branches, one commencing in Clerkenwell, and terminating in the parish of Walthamstow by a junction with the Northern and Eastern Railway; the other commencing at Broxbourn, and terminating at Cheshunt by a junction with the Northern and Eastern Railway.

Hampton-in-Arden, Leamington, and Warwick Railway.—Commencing by a junction with a branch line from the Birmingham and Derby Junction Railway, near where it joins the London and Birmingham at Hampton-in-Arden, and terminating at Warwick, with a branch from Hampton-in-Arden, terminating near the line of the Warwick and Birmingham canal, and also to form a junction with the London and Birmingham Railway.

Horsham Railway.—Commencing by a junction with the London and Brighton Railway, at Horley, terminating near East-street, Horsham.

Leamington and Warwick Union Railway.—Commencing out of the London and Birmingham Railway, at or near Coventry, and terminating at Leamington Priors, with a branch to St. John's Street, Warwick.

Leeds and Bradford Railway.—Commencing at Leeds, near the west side of the North Midland Railway, and terminating at Horton-lane, Bradford.

Leek and Stoke-upon-Trent Railway.—Commencing near the canal wharf, Leek, and terminating at Wenton's wood, near Stoke-upon-Trent.

London and Blackwall Railway.—To alter, amend, and enlarge some of the powers of Acts, to alter the position of the station near Fenchurch street, and the space for the standing of carts, coaches, &c., authorised by former Act, to Mark-lane.

London and Chatham Railway.—Commencing by a junction with the London and Greenwich Railway, at or near the Deptford station, and terminating in the parish of Frindsbury, adjoining the river Medway, opposite the town of Chatham, and to continue the line by means of a floating bridge or boats across to Chatham.

London, Lewes, St. Leonards, and Hastings Railway.—Commencing by a junction with the London and Brighton Railway, in the parish of Keymar, and terminating near the Fountain Inn, St. Leonards.

Manchester and Derby Railway (Churnet valley).—Commencing at the line of the Manchester and Birmingham Railway, in the parish of Cheadle, and terminating at the town of Derby, and near the joint station of the North Midland, Midland Counties, and Birmingham and Derby Junction Railways; also for power to make a branch to join the intended Macclesfield Railway, in the parish of Prestbury.

Milton and Frindbury Railway.—Commencing near New Tavern Fort, Milton, Gravesend, and terminating near the banks of the river Medway.

Northern and Eastern Railway Extension.—For power to alter, amend, and extend powers and provisions of Acts, and to make a railway, commencing by a junction with the said railway, at Hockerill, and terminating near Downing-terrace, St. Andrew the Less, county of Cambridge.

Northern Union Railway.—Commencing by a junction with the intended deviation line of the Great North of England Railway, parish of St. Oswald, and terminating upon the line of the Durham Junction Railway, at Houghton-le-Spring, with branches to Gilligate, and for power to incorporate a Company.

Norwich and Yarmouth Railway.—Commencing near Carrow-bridge, Norwich, and terminating near the Suspension-bridge, Great Yarmouth.

Norwich and Yarmouth Railway.—Commencing near Foundry-bridge road, Norwich, and terminating near the confluence of the rivers Yare and Bure, Little Yarmouth, in the borough of Great Yarmouth, to alter and divert the channel of the river Yare, where the said railway is intended to cross it, also for power to make a road from Great Yarmouth to the terminus of the said railway.

Penwortham and Stansfield Railway.—Commencing by a junction with the North Union Railway, at Penwortham, and terminating by a junction with the Manchester and Leeds Railway, in the township of Stansfield.

Saundersfoot Railway and Harbour.—To alter, amend, and enlarge powers and provisions of Acts, also for power to extend the railway from Wisemansbridge, in the county of Pembroke, to near the Lower Level Colliery, in same parish, with branches to Saundersfoot Harbour, and East Williamson.

Scarborough and York Railway.—Commencing near the town of Scarborough, and terminating by a junction with the York and North Midland Railway in the parish of St. Mary, York, with branches to St. Vincent's Pier, and terminus of the Whitby and Pickering Railway, at Pickering, and to New Malton.

Shoreham and Worthing Railway.—Commencing by a junction with the Shoreham branch of the London and Brighton Railway, and terminating at the north side of the town of Worthing.

South Eastern Railway.—To make a branch railway commencing by a junction with this line in the parish of Smorden, and terminating at Hastings.

South Eastern Railway.—Or to incorporate a Company to make branches therefrom, one to the Canterbury and Whitstable Railway at Canterbury, one to Ramsgate, and another to Margate.

Stockton and Hartlepool Railway.—To incorporate a Company to make a railway, commencing out of the Clarence Railway, in the parish of Billingham, and terminating either by a junction with some part of the harbour, or by a junction with the Hartlepool Railway, within a quarter of a mile of the Staiths for drops on land belonging to the Stockton and Hartlepool Railway Company.

West Ham Railway.—Commencing by a junction with the Northern and Eastern Railway, and terminating near the river Lea, West Ham.

West London Railway Extension.—Commencing at the terminus of the West London Railway, near the basin of the Kensington canal, and terminating near Montpelier-place, Knightsbridge, also a branch to the north side of the river Thames, near Hob-lane, Chelsea.

Westminster-bridge, Greenwich, Croydon, Brighton, and South Eastern Junction Railway, by way of, and including Kennington, Camberwell, and Peckham.—Commencing at the Thames, near the south foot of Westminster-bridge, and terminating by a junction with the London and Greenwich Railway, near High-street, Deptford, with a branch to the Croydon Railway, at New Cross.

Westminster Bridge Road Railway.—Commencing by a junction with the London and Greenwich Railway at Bermondsey, and terminating near the Westminster Bridge-road, between York-road and Lambeth-marsh.

Westminster and Staines Railway.—Commencing near the junction of the Kensington and Fulham turnpike roads, St. Margaret's, Westminster, and terminating near the city boundary stone, on the bank of the Thames, Staines.

York and Scarborough Railway.—Commencing by a junction with the York and North Midland Railway at York, and terminating near Folly-lane-fields, Scarborough, also to make a branch railway, terminating by a junction with the Whitby and Pickering Railway, near the Pickering station, also to alter the level of a branch of the Great North of England Railway.

MISCELLANEOUS.

Railway from Southampton to Salisbury.—We beg to call the attention of our readers to the importance of connecting Salisbury with our railway at this town, with the view of ultimately extending the line along the coast of Dorset, so as to make Southampton the great centre of all the South Western traffic. A few years back a prospectus was issued for making a railway between Southampton and Salisbury, through Romsey, and we believe the necessary surveys were made. If some influential parties would revive the subject, we have no doubt as to a successful result. All the share-holders in the South Western Railway are vitally interested in the matter, and must give such an undertaking their support, not only with a view to its ultimate extension along the coast, but from the certainty of its alone becoming a valuable source of profit to the South Western line.—*Hampshire Independent.*

Artesian Well.—The works of this important undertaking were resumed about a fortnight since, but we regret to learn, that after working one of the engines about ten hours, an accident occurred by the breaking of the fly-wheel shaft of the north engine—the cause of which it appears is not as yet accounted for. The making and fixing a new shaft will necessarily occasion some delay, but equal exertion will no doubt be used on this to that used on former occasions when accidents have happened. It seems that by the present arrangements immense quantities of water can be raised from the shaft to the surface, as on Monday, with only one engine and one pump at work—and those working only at one-half the speed to which the engine is equal, the quantity of water delivered from the pump nozzle, exceeded 12,000 gallons per hour; and this, too, when the water to be raised was upwards of 150 feet from the surface level. The present depth of the shaft is 300 feet, the excavation for a large portion of which is upwards of sixteen feet diameter. We have reason to believe that for the purpose of obtaining a supply of water there has been no other shaft constructed of so large a diameter, or with such durable material, for so great a depth. The difficulties encountered in sinking the shaft thus far have been of no ordinary kind, notwithstanding which, no one engaged in the undertaking appears to be discouraged. On the contrary, each misfortune appears to excite fresh exertions. The commissioners and contractors have decided to sink the shaft to a much greater depth, which, in our opinion, is preferable to the plan of boring to so great a depth as was originally intended. We heartily wish the undertaking every success, but whatever the result may be, the inhabitants of Southampton will, by this work, solve the important problem whether or not a copious supply of good water can be obtained by sinking a capacious shaft in a basin geologically situated as is their increasing town, and as is also similarly situated the great metropolis and its suburbs.—*Hampshire Independent.*

Development of Traffic by Railways.—One of the most striking instances we have seen of the increase of traffic on Railways, appears in the Garnkirk and Glasgow Railway. This railway, the influence of fares on which was a session or two ago made the subject of considerable discussion in the House and the country, has been opened several years, and by a table appended to the Directors' report in our number for the 20th inst., it appears that the receipt for goods during 1832 was £4,758, and in 1840 it was £12,002, being an increase of near 153 per cent., in a tolerably steady manner, and the tonnages for goods in the same two years were 114,144 and 254,010, or 123 per cent more in the latter year. The passengers during the first of the two years was 62,605, and during the last 116,187, giving an increase of about 86 per cent. But during the year 1836 the number was 145,703. In this year (*R. M.*, 4to., vol. ii. p. 242), the fares were 6*d.* for second-class passengers; after that they were raised to 8*d.*, and the numbers fell off wonderfully. The fares now appear to be higher than 6*d.*, and hence no doubt the reason of the numbers being less instead of much higher than they were in 1836. The receipts for passengers in 1832 were £1,718, and in 1840 they were £3,712, that is, about 116 per cent. more; and the total receipts for passengers and goods were, in 1832, £6,476, and in 1840 £15,714, or above 142 per cent. higher. Nothing can more clearly show the influence of railways in the development of traffic than this line exhibits. Notwithstanding the injurious effects of increase of prices, the traffic has increased and the receipts risen above 142 per cent. This should afford consolation to the Shareholders in those lines which do not yet come up to expectation, and should teach them to be cautious how they dispose of property because it does not at first do all that they anticipated. Nothing can be more unwise. We remember a recent case of a gentleman losing £2,000 by such unwise conduct.—*Railway Magazine.*

French Railways.—The Orleans railway, which was only completed as far as Corbeil, is now likely to be again carried on with vigour. Engagements have been entered into with contractors, and the rails and engines are already ordered. The plans have been examined by the Conseil General des Ponts et Chaussés, and there remain only some minor points to be determined.

All difficulties having been surmounted, the line will pass in the direction of Etampes. It has been remarked, that it would be more for the general interest of the country, if the Versailles lines were made use of as far as they went, and the affairs of these two railways, which are at present in a depressed state, would be much benefited; and by this means, the lines to the North might be united to several of those in the interior.

The railway to Corbeil might form the first step of that to Burgundy, which would thus have a beginning. It is to be regretted that this plan has not been taken into consideration. But the most important point, which is now determined upon, is, that the Orleans railway should be continued.

The railway from Orleans to Vierzon, recommended to public attention

by the Director of the Company at Orleans, M. Casimir Leconte, is likely to be taken up. Meetings have been held, and the authorities of several towns have passed resolutions in favour of furnishing the interest upon loans for several millions, for furthering the undertaking. A continuation of the railway from Orleans to Nantes is also talked of, surveys of which have been made, with great care. The town of Blois has guaranteed the interest of a million towards the scheme.

The Bâle and Strasbourg Railway, which is five leagues longer than that to Orleans, will be opened throughout in the course of this year.

A plan for a railway from Paris to Meaux is also before the public, the bill for which will be forthwith presented to the Chambers.—*Courrier de l' Europe.*

Cornish Engines—The number of pumping engines reported this month is 50. They have consumed 3557 tons of coal, and lifted 35 million tons of water ten fathoms high. The average duty of the whole is therefore 55,000,000 lbs., lifted one foot high by the consumption of a bushel of coal.

Depth of Mines.—Coal has been obtained near Praticroft, in Lancashire, on the land of T. J. Trafford, Esq., at the depth of 1,350 feet from the surface. "We have not heard of a shaft before," observes the *Manchester Times*, "equal in depth to this." We inform our contemporary, that Messrs. Pemberton, in 1834, reached a seam of coal in Monkwearmouth at the depth of 1,578 feet below the surface; and have since sunk to a still greater depth, their mine being, not we believe the deepest in the world below the level of the sea, but the deepest below the surface of the earth.—*Gateshead Observer.*

Improvement in the Steam Engine.—A patent has lately been taken out by Mr. Thomas Stather, foreman to Messrs. Overton and Wilson, founders and steam engine manufacturers, for an invention of his own, viz., the introduction of what he calls the steam-engine "controller." This new invention is for reversing the motion of the engine, and that instantly, by a most simple contrivance. The inventor states that his controller may be fixed in front of the helm, or a duplicate may be fixed on the paddle-box top, or centre of the platform (from paddle-box to paddle-box), so that the man at the helm, or the captain, shall have full and perfect control of the engine. The working model which he exhibited at a lecture in the Mechanics' Institute, going at a rapid rate, obeyed, no sooner than the words of command were spoken, viz., "slow," "backward," "quick," "forward," "stop," to the surprise of all present. By the present method the engine is stopped by removing the eccentric out of its gear, but by this discovery the eccentric remains undisturbed. To large and powerful engines this will be a great advantage, they requiring at present so many men to move the valves, and which may in future be performed by a single individual with ease. In locomotive engines the extra eccentric rods will be dispensed with, only one being required, and thus saving from £ 200 to £ 300 in the cost.—*Hull Advertiser.*

Preservation of Wood.—A method, by Dr. Boucherie, has been invented of impregnating wood recently cut down, with conservative fluids. He erects pieces, cut of any length, on end, and envelops their upper ends with imperviable bags of cloth, which are reservoirs for the fluid of impregnation. Generally, he says, the sap begins promptly to flow out at the lower end, and the fluid to penetrate at the upper; but in some cases, where the wood is filled with large quantities of gas, this flowing off of the sap does not commence until the gas is expelled, and then the sap runs without interruption. When the fluid flowing from the bottom of the wood is the same as that at the top, the impregnation is completed.

The author says, that by this process he has been able in one day to collect, assisted only by two men, and operating on seven trees, 4,850 litres of sap. He says, he has also been able to extract saccharine, mucilaginous, &c. matters, and that it is possible to extract any resinous juices the wood may contain, by using liquids capable of dissolving these juices.

In reply to this, M. Millet has laid before the Academy of Sciences a patent granted to him the 29th of September last, for a method by which, he says, he can impregnate wood for any length of time after it has been cut down. We do not doubt these processes; but the question is not, whether wood can be impregnated with this liquid or that, but whether the wood can, by their impregnation, be effectually preserved, and whether there is any other process as economical as Kyan's, that will do it.—*Railway Magazine.*

Steam-Boiler and Water Indicator.—The French Academy of Sciences has reported on a plan proposed by M. Daillot to indicate when the boiler is in a state of danger from insufficiency of water. The plan is a hollow metallic cylinder, fixed in the boiler, and descending, with the under end open, to a given depth within the boiler, beneath which, if the water stands, there is too little water and danger, and above which there is sufficient and security. A hollow glass tube surmounts the metallic, and upon the top of the water, pressed up by reason of the elasticity of the vapour, floats a hollow glass ball. As long as the end of the tube is beneath the water in the boiler, the floating ball will be visible; but as soon as the water sinks below, the vapour, instead of the water, enters the tube, and the ball, by its specific gravity, falls to the bottom of it and disappears. It is conceived that the appearance or disappearance of this floating ball will be enough to call the attention of the engineer to the state of the boiler.

THE LETTER BOX.

An Enquirer remarks on the ignition of goods in carriages next the engine of a train, occasioned by pieces of burning coke blown from the chimney; and he proposes, as a preventive of such accidents, a tilt of iron wire worked with very small meshes. We offer no opinion on the proposal.

Zeno inquires what specific good the Institution of Civil Engineers has done to the business of engineering; and what particular engineering work is better executed than if no such institution had ever existed. This question is in the one part personal and invidious, and in the other indeterminate; and therefore we do not think it a legitimate subject of inquiry.

Q. may send us his "Proposed plan of a substitute for the present Patent laws and regulations," and if he does so we shall judge candidly of it; but we cannot promise *à priori* to give it a place in our journal. That nothing can be much worse than the present patent laws, we are ready to admit; but if any change is to be made, the matter should be thoroughly investigated, and a good system founded upon knowledge of the subject. As matters stand, the roll of patents possesses many of the characters of an obituary, only more of the patents are still-born than of the persons whose names usually make up a roll of the dead. It would be a curious, and not altogether unedifying speculation, to ascertain what fraction of the number of patents granted is at all noticed by the public—that is, comes at all before the world in any other way than to give an imposing appearance to an advertisement: and it would not be less curious or less edifying to ascertain what portion of them is of any utility. The fact is, that as matters stand at present, patents are puffs, and nothing but puffs; and when an article is introduced as patent, sensible people avoid it, as something which cannot stand upon its own merits, but which requires this mode of advertising to bolster it up, and give it a chance of imposing on the gullible part of the community. The fault of this is immediately in the law, which operates in favour of the puffs of those who can afford to pay the fees, but represses, and cuts off from all chance of success, those who are not so able.

Now, in as far as our experience goes—and we have attended a good deal to the subject, the men who cannot afford to pay for a patent, are the very men whose inventions would be really useful. The ordinary patentee, in the great majority of cases, knows little or nothing of the subject to which his patented invention is meant to apply. Thus, for instance, a tailor takes out a patent for a contrivance to prevent accidents on railways, or a stockbroker takes out one for a supposed improvement on ploughs, or some other agricultural implements; whereas the tailor is almost as ignorant as his goose of the whole structure and management of a railway engine and train, and the stock-broker knows no more about the good qualities of a plough than the horses by which the said plough is drawn. Such cases, however, are of frequent occurrence; and they show that there is something especially pernicious in the present state of the patent law. But when an operative man proposes an improvement of that about which he is daily occupied, and which of course he knows intimately, the case is widely different. What he suggests must be a real and useful improvement, because his grand motive is the lessening of his own labour in that which he has to produce; and therefore, if the law were what it ought to be, protection to whatever he invents ought to be freely and gratuitously afforded to him, while the mere speculator in matters of which he knows nothing, ought to be repressed, and kept out of the field by every lawful means.

These few short replies must suffice for the present month: we have

many others worthy of notice, but some of them came too late in the month, and all require more consideration than we can at present bestow. We, however, cordially invite correspondence to the class alluded to; and shall upon all occasions endeavour to do them justice.

LIST OF PATENTS,

Continued from page 48.

(SIX MONTHS FOR ENROLMENT.)

George England, of Westbury, Wiltshire, clothier, for "improvements in machinery for weaving woollen and other fabrics, and for twisting, spooling, and warping woollens, also for improvements in the manufacture of woollen doeskins."—Sealed March 2.

John Wilkie, of Nassau Street, Marylebone, upholsterer, and John Charles Schwieso, of George Street, Saint Pancras, musical instrument maker, for "improvements in the constructing elastic seats or surfaces of furniture."—Sealed March 4.

Henry Newson Brewer, of Jamaica Row, Bermondsey, mast and block maker, for "an improvement or improvements in wooden blocks for ship's rigging, tackles, and other purposes where pullies are used."—Sealed March 3.

John Rand, of Howland Street, gent., for "improvements in preserving paints, and other fluids."—Sealed March 6.

James Johnson, of Glasgow, gent., for "certain improvements in machinery for the manufacture of frame-work knitting, commonly called hosiery, and for certain improvements in such frame-work knitting or hosiery."—Sealed March 8.

Thomas Spencer, of Liverpool, carver and gilder, for "an improvement or improvements in the manufacture of picture and other frames and cornices, applicable also to other useful and decorative purposes."—Sealed March 8.

John William Neale, of William Street, Kennington, engineer, and Jac ue Edouard Duyck, of Swan Street, Old Kent Road, commission agent, for "certain improvements in the manufacture of vinegar, and in the apparatus employed therein."—Sealed March 8.

John Varley, of Bayswater, artist, for "an improvement in carriages."—Sealed March 8.

Benjamin Smith, of Stoke Prior, Worcester, butcher, for "an improved apparatus for making salt from brine."—Sealed March 8.

John Walker, of Crooked Lane, King William Street, builder, for "an improved hydraulic apparatus."—Sealed March 8.

Richard Lawrence Sturtevant, of Church Street, Bethnal Green, soap manufacturer, for "certain improvements in the manufacture of soap."—Sealed March 8.

Thomas Joseph Ditchburn, of Orchard House, Blackwall, shipbuilder, for "certain improvements in shipbuilding, some or all of which are applicable to steam boats, and boats and vessels of all descriptions."—Sealed March 8.

Anthony Todd Thompson, of Hinde Street, Manchester Square, doctor of medicine, for "an improved method of manufacturing calomel and corrosive sublimate."—Sealed March 8.

Stephen Golden, of West Street, Finsbury Circus, merchant, for "improvements in preserving animal and vegetable substances, and liquids."—Sealed March 8.

John Wertheimer, of West Street, Finsbury Circus, printer, for "improvements in preserving animal and vegetable substances, and liquids," being a communication.—Sealed March 8.

Thomas Clerk, professor of chemistry in Marischal College University, of Aberdeen, for "a new mode of rendering certain waters (the water of the Thames being among the number) less impure and less hard, for the supply and use of manufactories, villages, towns, and cities."—Sealed March 8.

John Baptist Fried Wilhelm Hermann, of Ludgate Hill, merchant, for "improvements in the manufacture of ropes and cables," being a communication.—Sealed March 8.

John Dockree, of Galway Street, St. Luke's, gas fitter, for "an improvement or improvements on gas burners."—Sealed March 15.

Richard Laming, of Gower Street, Bedford Square, surgeon, for "improvements on the production of carbonate of ammonia."—Sealed March 15.

William Newton, of Chancery Lane, civil engineer, for "certain improvements in machinery or apparatus for picking and cleaning cotton and wool."—Sealed March 15.

Robert Warnington, of South Lambeth, gent., for "improvements in the operations of tanning."—Sealed March 16.

Joseph Maudslay, of Lambeth, engineer, for "an improvement in the arrangement and combination of certain parts of steam engines, for steam navigation."—Sealed March 16.

William Newton, of Chancery Lane, civil engineer, for "improvements in spinning and twisting cotton and other materials, capable of being spun and twisted," being a communication.—Sealed March 16.

George Lowe, of Finsbury Circus, engineer to the chartered gas company, for "improved methods of supplying gas under certain circumstances, and of improving its purity and illuminating power."—Sealed March 16.

Charles Bunt Dyer, of Pary's Mine, Anglesea, mine agent, for "an improved method of obtaining paints or pigments, by the combination of mineral solutions with other substances."—Sealed March 16.

Lawrence Kortright, of Oak Hall, East Ham, esq., for "certain improvements in treating and preparing the substance commonly called whalebone, and the fins and such like other parts of whales, and rendering the same fit for various commercial and useful purposes," being a communication.—Sealed March 17.

William Thompson Clough, of St. Helen's, Lancaster, alkali manufacturer, for "improvements in the manufacture of carbonates of soda and potash," being a communication.—Sealed March 17.

Henry Augustus Wells, of Regent Street, gent., for "improvements in machinery for driving piles," being a communication.—Sealed March 17.

Joshua Field, of Lambeth, engineer, for "an improved mode of effecting the operation of connecting and disconnecting from steam engines the paddle wheels used for steam navigation.—Sealed March 22.

Richard Barnes, of Wigan, Lancaster, engineer, for "certain improvements in machinery, or apparatus for raising or drawing water or other fluids."—Sealed March 22.

Anthony Theophilus Merry, of Birmingham, refiner of metals, for "an improved process or processes for obtaining zinc and lead from their respective ores, and for the calcination of other metallic bodies."—Sealed March 22.

Robert Walter Winfield, of Birmingham, merchant, for "certain improvements in, or belonging to, metallic bedsteads, a portion of which may be applied to other articles of metallic furniture."—Sealed March 22.

Robert Goodacre, of Ullesthorpe, Leicestershire, for "an improved mode of weighing bodies raised by cranes or other elevating machines."—Sealed March 22.

David Napier, of Mill Wall, Poplar, engineer, for "improvements in propelling vessels."—Sealed March 22.

Achille Elie Joseph Soulas, of George Yard, Lombard Street, merchant, for "improvements in apparatus for regulating the flow of fluids," being a communication.—Sealed March 22.

William Bucknell, of Westminster, gent., for "improvements in applying heat for the purpose of hatching eggs, which improvements are also applicable to other useful purposes."—Sealed March 22.

Morris West Ruthven, of Rotherham, engineer, for "a new mode of increasing the power of certain media, when acted upon by rotary fans or other similar apparatus."—Sealed March 22.

Robert Cook and Andrew Cunningham, of Johnstone, near Glasgow, engineer, for "improvements in the manufacture of bricks."—Sealed March 22.

Moses Poole, of Lincoln's Inn, gent., for "improvements in stretching cloths," being a communication.—Sealed March 22.

Joseph Wright, of Carisbrook, Isle of Wight, mechanic, for "improvements in apparatus used for dragging or skidding wheels of wheeled carriages."—Sealed March 22.

Thomas Wright, of Church Lane, Chelsea, lieutenant, for "certain improvements applicable to railway and other carriages."—Sealed March 22.

Edward Finch, of Liverpool, ironmaster, for "improvements in propelling vessels."—Sealed March 25.

Goldsworthy Gurney, Esq., of Bride Cornwall, for "improvements in the production and diffusion of light."—Sealed March 25.